

2018

New Courland, Tobago: A GIS analysis of a 17th-century settlement

Amanda Sumner
University of Central Florida



Part of the [Archaeological Anthropology Commons](#)

Find similar works at: <https://stars.library.ucf.edu/honorsthesis>

University of Central Florida Libraries <http://library.ucf.edu>

This Open Access is brought to you for free and open access by the UCF Theses and Dissertations at STARS. It has been accepted for inclusion in Honors Undergraduate Theses by an authorized administrator of STARS. For more information, please contact STARS@ucf.edu.

Recommended Citation

Sumner, Amanda, "New Courland, Tobago: A GIS analysis of a 17th-century settlement" (2018). *Honors Undergraduate Theses*. 313.
<https://stars.library.ucf.edu/honorsthesis/313>



STARS
Showcase of Text, Archives, Research & Scholarship

NEW COURLAND, TOBAGO:
A GIS ANALYSIS OF A 17TH-CENTURY SETTLEMENT

by

AMANDA SUMNER

A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Anthropology
in the College of Sciences
and in the Burnett Honors College
at the University of Central Florida
Orlando, Florida

Spring Term, 2018

Thesis Chair: Scott Branting, Ph.D.

ABSTRACT

In the 17th and 18th centuries, the Caribbean island of Tobago was contested by several European powers. Among them was an unlikely colonizer, the small Duchy of Courland, located in the western part of modern-day Latvia, which established the New Courland colony on the west coast of Tobago, in May 1654. The aim of this study was to determine the exact geographic location of this settlement through examination of historical texts, maps, and geographic information systems (GIS) data. Remote sensing and GIS methods were used to map the Courlander Fort Jacob on the site of an earlier Dutch fortification, Nieuw Vlissingen. Subsequently, a predictive model was created in ArcGIS to analyze the probability of a 17th-century animal-powered sugar mill location on the territory of an 18th-century British sugar estate. Several locales were identified as matching the model criteria. The results of this study contribute to the knowledge about the New Courland colony and can be used in the design of a future archaeological fieldwork project.

TABLE OF CONTENTS

INTRODUCTION	1
BACKGROUND INFORMATION	4
Tobago colonial history.....	4
Pre-colonial and early colonial period.....	4
New Courland 1654-1659.....	6
Post-1660 Tobago: conflict and abandonment	14
The British Era	18
Sugar mill construction	19
Previous archaeological research	21
METHODS	23
Methodology literature review	23
Datasets and data types	26
Stage one: mapping the fort	28
Stage two: Predictive sugar mill location model.....	29
RESULTS AND DISCUSSION	38
Part one: fort	38
Part two: sugar mill.....	41
Limitations of study	45
CONCLUSION	46
REFERENCES	48

LIST OF FIGURES

Figure 1: The Duchy of Courland and Semigallia and its colonies in the 17th century.....	7
Figure 2: Maps of a 17th-century Tobago fort	9
Figure 3: Illustration of an animal-powered sugar mill from Charles de Rochefort's <i>Histoire morale des Iles Antilles de l'Amérique</i> (1667)	19
Figure 4: A sugar mill in the French West Indies.....	20
Figure 5: Plan and outline of Fort Jacob	28
Figure 6: Features surveyed on Courland Estate	30
Figure 7: Tobago digital elevation model from JAXA AW3D30 dataset.....	32
Figure 8: Observer points for visibility analysis.....	33
Figure 9: Visibility from the fort	34
Figure 10: 5 km catchment area around the fort with cost distance	35
Figure 11: Perennial and seasonal waterways and buffer corridors	37
Figure 12: Lidar image of the fort area	39
Figure 13: Fort Jacob 1654 outline overlaid on the aerial imagery of Plymouth, with the Courland Monument in the center of the fort	40
Figure 14: Predictive location model	42
Figure 15: The area of New Courland colony, also known as Courland side, and locations referenced in this text.....	43
Figure 16: Aerial photo of Courland estate area with 1995 survey features	44

INTRODUCTION

Tobago is the smaller, northeastern island of the Caribbean nation of Trinidad and Tobago in the Lesser Antilles. In the centuries of its colonial history, it has changed hands at least thirty times. The earliest attempts of Europeans to establish a settlement on Tobago were made by the Dutch, in 1628 and 1633, who built a fort near modern-day Plymouth and named it Nieuw Vlissingen. The first colony was abandoned and the second was destroyed by a Spanish attack in 1636 (Boomert, 2015).

Jacob Kettler, the Duke of Courland, a small Duchy in the western part of modern-day Latvia, acquired ownership of Tobago in the 1640s. Eighty colonist families from Courland and 124 soldiers, led by Captain Willem Mollens, departed for Tobago in November 1653 and arrived at the Great Courland Bay on May 20, 1654. With Mollens as their governor, the colonists established Fort Jacob and renamed the island to New Courland. In the following years, a village and clusters of warehouses spread around the fort. The colonists built plantations in the surrounding area where they farmed sugarcane, indigo, tobacco, and ginger. A large plantation owned by Duke Jacob himself was located on 200-280 hectares between Fort Jacob and Black Rock, along the Courland River, in the area currently known as Courland Estate (Anderson, 1970, p. 118).

The exact location of Fort Jacob has been subject to controversy and misinformation. An assumption, often repeated on travel websites and tourist guides, states that the Courland fort and the first permanent settlement on Tobago shared the location with

the 18th-century British Fort James in Plymouth. A sign placed by the Tobago Trust at Fort James states that this fort was named after “James, Duke of Courland, whose settlers were here circa 1650.” Anderson, however, believes that the actual location of Fort Jacob was in the open field between the Plymouth police station, St. David’s Church, and the Courland Bay. His claim is supported by several 17th-century maps. A modern art sculpture by a Latvian artist was placed in this location in 1978 to commemorate the Courland colonists. The first part of my research used a combination of documentary sources, remote sensing, and Geographic Information Systems (GIS) methods to determine whether Fort Jacob was built on the site described by Anderson, on the remains of the earlier Dutch Fort Nieuw Vlissingen.

The locations of Courland plantations have not been mapped and are currently unknown. However, there are records of sugar mills, estates, and villages associated with them from the later British period, starting in the 1760s. During an archaeological survey of the British Tobago sugar estates, a pottery sherd dated to the period of the 17th-century Courland colony was found on the estate village of the Courland Estate (Clement, 1995). Based on this artifact find, I proposed that the 18th-century British sugar mill on Courland Estate was built on the site of a Courland plantation. In the second part of my thesis, a predictive GIS model was created to test this hypothesis.

The purpose of this research is, first of all, to put the New Courland colony on the map, and subsequently, to clear up some of the historical inaccuracies present in the literature. Scholarly articles on Tobago continue to cite earlier sources which are based on unsubstantiated claims about dates, names, and locations of the 17th-century

European colonies. In addition to establishing historical accuracy, mapping potential archaeological sites of the Courland colony is the first step leading to a long-term research project. The map and the story of the Courland colony are anticipated to be published for open access as an Esri Story Map.

New Courland is part of the cultural heritage of Tobago and Latvia in equal measure. Tobago's economy is heavily dependent on tourism. Sites of colonial forts and mills attract visitors to the island. Courland's presence, albeit mostly in place names, adds a unique appeal. Tobago also holds a particular significance for the Latvian national identity. An annual Latvian diaspora gathering takes place on Tobago every June. The Courland monument in Plymouth reinforces the idealized view of the Duke Jacob's colony as an embodiment of freedom and enterprise, ignoring the inconvenient details of the transatlantic slave trade and the harsh reality of the settlers' lives. In view of the current gaps in understanding of the Tobago - Latvian connection, I expect the results of my research to be relevant on both sides of the Atlantic.

BACKGROUND INFORMATION

Tobago colonial history

Pre-colonial and early colonial period

At the time of the European arrival, Tobago was inhabited by the Kali'na people and frequently visited by the Island Caribs (Kali'nago) and Trinidad Arawaks. The island acted as a halfway stop on the trade route between the Venezuelan coast, the Guianas, and Trinidad to the south and the Windward Islands to the north (Boomert, 2015).

First sighted by Columbus in 1498, Tobago remained free from European colonizers until the 17th century. The British considered it too close to the Spanish colonies on Trinidad. The Spanish, meanwhile, were comfortably settled on the larger neighboring island and were reluctant to deal with the aggressive indigenous population of the smaller Tobago. In the first twenty years of the 17th century, the Spanish interest in Tobago was limited to small-scale slave raids. The Kali'na retaliated fiercely and halted any Spanish attempts at a settlement on the island. Reports from ship captains, Goddard in 1626 and Gijz in 1627, describe Tobago as uninhabited by Europeans but rich in resources and suitable for colonization (Huyghues-Belrose, 2007).

The first successful, albeit temporary, European settlement on Tobago was achieved by the Dutch in 1628. A group of sixty-eight settlers, financed by a Zeeland merchant and mayor of Vlissingen, Jan de Moor, founded a tobacco plantation along the Great Courland Bay. It was abandoned in 1630, unable to defend against raids of Island Caribs from St. Vincent. The second group of two hundred colonists, led by Cornelis de Moor,

the son of Jan de Moor, arrived at the same location in 1633. A Dutch map titled *Bird's eye view of the bay and the fort of Nieuw Vlissingen on Tobago*, published in the Vingboons Atlas in 1665, shows the fort surrounded by tobacco fields on the coast near the mouth of the Courland River. Another, smaller fortification is at Black Rock. The next time we see Nieuw Vlissingen on a map it is being attacked by Spanish forces from Trinidad in 1636 (Anderson, 1970, plate XII). While the factual accuracy of this image can be disputed, it gives the impression that the Dutch settlements were fairly spread out inland on both sides of the Courland River and along the coast between the two forts. The Spanish besieged the fort, and the Dutch surrendered, on a condition that they were allowed to leave Tobago except for de Moor who was captured and taken to Spain (Goslinga, 1971).

The next decade, following the fall of Nieuw Vlissingen, is characterized by multiple brief and unsuccessful attempts of various nations and private individuals to establish colonies on Tobago. Most notably, an expedition from Zeeland, financed by Duke Jacob of Courland and led by Captain Caron, was sent to Tobago in 1642 to establish a colony and initiate trade contacts with the Arawaks of Trinidad. Settlers came ashore in the Mount Irvine area but were soon attacked by the Island Caribs of St. Vincent who were at war with the Arawaks. It is unclear how long Caron's settlement lasted, with sources ranging between a few months and as late as 1650 (Sooman et al., 2013), which seems highly unlikely. Eventually, seventy surviving Zeelanders were rescued by the Arawaks and transported to coastal Guiana, where they established a colony on the Pomeroon River (Goslinga, 1971). During the same time period, The Earl of Warwick had drawn up

a proposal for an English colony on Tobago, but there is no evidence that this settlement went beyond the planning stage (Harlow, 1925/2017).

New Courland 1654-1659

Sources vary on how precisely the Duke of Courland Jacob Kettler came in possession of Tobago. A popular version of the events is that Tobago was a baptism gift from Jacob's godfather King James I in 1610. In the 1640s, however, Tobago was the property of the Earl of Warwick. According to Matthiesen (1940), even if a deal of purchase of Tobago from Warwick was negotiated, there is not a single piece of documentary evidence of the acquisition of Tobago by Duke Jacob in the ducal archives or elsewhere. In either case, Courland's legal rights on Tobago were acknowledged by all parties and not disputed.

In the early 1650s, Courland was thriving under the rule of the young, educated, and enterprising Duke Jacob, who inherited the Duchy after the death of his uncle Duke Friedrich Kettler in 1642. The Duke's focus was on the industry, particularly iron works, and shipbuilding. Courland's fleet was the largest in the Baltic Sea. During Jacob's reign, the Windau shipyard produced 79 merchant ships and 44 men-of-war, ranging from six to seventy-two guns. A total of 59 warships were built in all Courland shipyards during this period, a number of which were sold to England and France (Kenins, 2014). In 1651, Duke Jacob acquired St. Andrew's Island on the Gambia River (now Kunta Kinteh Island) and several mainland trade posts in the Gambia, West Africa. An outpost in the West Indies was needed to establish a profitable transatlantic trade triangle (Figure 1).

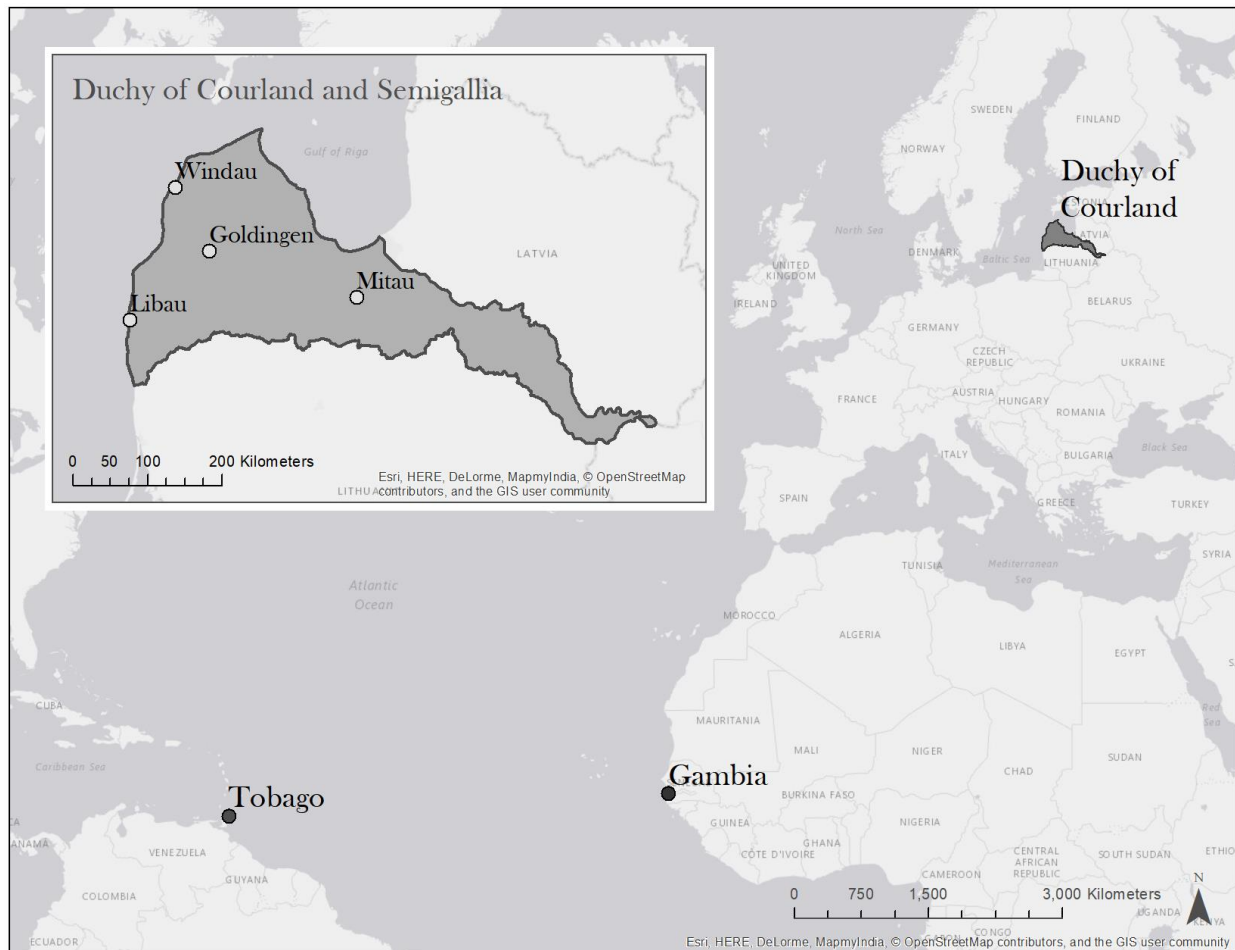


Figure 1: The Duchy of Courland and Semigallia and its colonies in the 17th century

No longer trusting the Dutch to do the job under the flag of Courland, the Duke hired a multinational crew for *Das Wappen der Herzogin von Kurland*, a powerful frigate with 45 guns, built locally in the shipyard of Windau (Ventspils). Willem Mollens was chosen to lead the expedition. He was the son of Admiral Willem Mollens Sr. who had recently completed an expedition to Brazil, via the Gambia, and had died during the return voyage. *Das Wappen der Herzogin von Kurland* departed Windau in November 1653 with a crew of twenty-five, 124 soldiers, and eighty colonist families. After an uneventful

voyage, the ship anchored at the Great Courland Bay on May 20, 1654. Mollens as the new governor of the colony claimed Tobago for the Duke of Courland and named the island New Courland.

Most of the original documents from this expedition, including Mollens' journal, have been lost along with a portion of the Courland archives, which were relocated to St. Petersburg in 1905 (Matthiesen, 1940). Even more documents were destroyed in Berlin during World War II. Lists of colonists have not survived. It is likely that some of the Couronian colonists were serfs sent to Tobago as a punishment for crimes or considered undesirable by their masters in Courland, as was a common practice at the time. Others would have been attracted by the promise of freedom and land ownership.

A letter from Willem Mollens, dated August 11, 1654, and sent to the Duke on the returning ship *Das Wappen der Herzogin von Kurland*, is a rare piece of documentary evidence from the Courland colony. Matthiesen located this document in the Latvian State archives sometime before World War II and described it as written in bad handwriting, on poor quality paper, in broken Dutch. In the letter, Mollens reports a successful takeover of Tobago or New Courland. However, he has encountered five "chiefs of savages" whom each command twenty-five men. Each chief has a canoe made from a hollowed tree, in which they go to war against the Arawak people who live on Trinidad and the mainland. The Arawaks, in return, raid Tobago with 50 or 60 canoes with twenty-five or thirty men in each, and the locals are very wary of them. Mollens has attempted to make friends with the local Caribs and has been trading hatchets, knives, and mirrors for hammocks. He complains that there is a constant traffic of canoes from

both the mainland and other islands, and the colonists are never left in peace. Finally, Mollens begs for the mercy of his grace the Duke to help his wife and four children he left at home and to grant them money for upkeep, and to pay off the debt to the builders of his house, since he has spent everything on this expedition. With the letter, Mollens encloses a small package of furs and skins, as well as a map of the fort and its surroundings.

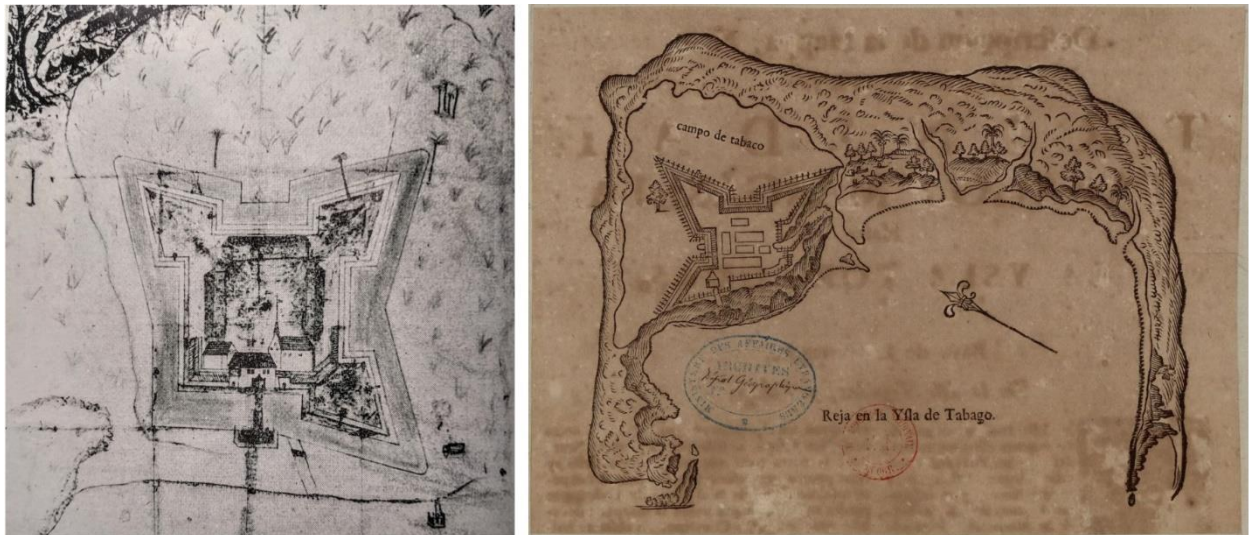


Figure 2: Maps of a 17th-century Tobago fort

Left: plan of Fort Jacob, possibly by Willem Mollens, 1654 (Anderson, 1970, plate XVI). Right: an undated Spanish 17th-century map of a fort at the Great Courland Bay (Bibliothèque nationale de France).

The map, located by Matthiesen in the Courland archives in Berlin, was destroyed during World War II and only a black and white photograph remains (Figure 2, left). The original was drawn in ink and watercolor and shows a complete fortification with a small moat, stone walls, and three bastions. Inside is a white stone church with a red

shingle roof and a weathervane on top of its spire, two other stone buildings, and three wooden barracks. Matthiesen notes that this cannot be the same map that Mollens sends three months after landing on Tobago. The colonists would not have had the time to complete the construction. Anderson, however, after substantial archival research and comparison with other sources, believes the map to be genuine. If we take into account that the Dutch had already built a fort on the same spot twenty years prior, the Courland settlers only had to restore and improve the existing structures. An undated 17th-century Spanish map shows a fort in the same location (Figure 2, right). It has earthworks on three sides and wooden palisades, and several outlines of buildings inside the fort. Trees are felled on the island across the river from the fort, which implies a construction in progress. The fort is surrounded by tobacco fields. The Vingboons map of Nieuw Vlissingen also shows a complete fortification with enclosed buildings. It is likely that seventeen years after the abandonment of the Dutch colony, Mollens would find most of the fort structures still in place.

One of the most disputed questions regarding the Tobago colony is the ethnic composition of the Courland settlers. Opinions range from Matthiesen's complete denial of the existence of any ethnic Couronian colonists to the belief perpetrated by the early 20th century Latvian popular media that Tobago was almost entirely settled by Latvian peasants. Neither of the extremes is plausible. Matthiesen postulates that Latvian Couronians were excluded entirely from the German cultural sphere, with no social interaction between the two groups beyond the landholder and serf relationships. Several examples disprove this idea, including lists of employees of the Windau

shipyard. In 1658, among the 62 officials and craftsmen, there were eighteen Dutch, seven Germans, and thirty-seven Latvians. All the apprentices and workers were Latvian. In 1671, there were four German and two Latvian officials and sixty-eight craftsmen, only nineteen of which were German and the rest Latvian (Kenins, 2014, p. 31).

Matthiesen's view from his position of ethnic superiority that all Latvians in the Duchy of Courland were serfs is factually inaccurate. Descendants of Couronian nobility, who were minor vassals of the Livonian Order, retained their freeholder status. Couronian freeholders were usually baptized with German or Latin names regardless of their ethnic origin. Latvian names in records were commonly Germanized, making it impossible to accurately determine anyone's cultural identity and first language from the name alone. A 1655 oath of fealty, written in High German and signed by New Courland settlers, lists names which can be interpreted as either German or Latvian (Anderson, 1970, p. 114).

A Dutch West Indies Company representative Matthias Beck, who later became the governor of Curacao, stayed on Tobago for six weeks in 1654 and wrote about the conditions of the colony in his October 8, 1654, report. Land in New Courland was distributed according to rank, ranging between 300 morgens to a captain and 30 morgens to a serf (one morgen equals 0.27 hectares). Former serfs from Courland gained freedom on arrival and were entitled to own property, including slaves. African slaves were shipped to Tobago from the Gambia and paid for in produce and goods (Anderson, 1970, p. 116). Beck's first-hand report is a proof of the existence of both Couronian former serfs and enslaved Africans in New Courland. Duke Jacob's

involvement in the transatlantic slave trade is a matter that has not received sufficient coverage, and nothing is known about the Africans enslaved by New Courland colonists.

The population numbers of New Courland vary wildly among sources. Courland archivist Ewald von Kloppman's 1780 publication on ducal ships appears to contain the most accurate information, collected from original shipping documents. According to Kloppman, between 1654 and 1658, ten ships were sent from Courland to Tobago, bringing supplies, settlers, and soldiers. Several of the ships are listed as carrying between 120 and 150 "men," although it is unclear whether these numbers included crew, soldiers, or were the numbers of settlers complementing the colony (Matthiesen, 1940). In either 1655 or 1656, the Duke sent a Courland native, Wolfart von Brederow Clottring, to take over the command of the colony from Mollens, who was Dutch. A Lutheran pastor also arrived on Tobago to establish the first Lutheran church in the New World. Duke Jacob's directive to his colonial pastors instructed them to learn the local languages, maintain peace, avoid religious disputes between various faiths, and instead convert the locals with kindness and patience (Anderson, 1970, p. 121). Despite the presence of the Lutheran church, New Courland had complete religious freedom, with the only requirement for settlement being swearing a fealty oath to the Duke.

Tobago did not remain solely in the hands of Duke Jacob for long. In September 1654, a ship of Dutch colonists disembarked on the opposite side of the island. This venture was financed by the brothers Adriaen and Cornelis Lampsins from Zeeland. Once the colonists became aware of each other's existence, the Dutch submitted to the Duke of Courland and the island was unofficially divided between the Dutch and the Courlander

“sides” roughly by the mountain ridge in the middle. A Dutch town was built at Rockley Bay on the site of present-day Scarborough and named Lampsinsstad. This location benefitted from being away from the Carib and Arawak boat routes and did not suffer from their attacks as much as the Courland side. As a result, the Lampsins’ colony was growing and prospering. In the following years, Tobago greeted numerous arrivals, including ships of settlers to both Courlander and Dutch colonies, French turtlers, refugees from Barbados, and buccaneers who frequented the Jan de Moor Bay on the northern coast of Tobago. A group of 120 Jewish settlers from Livorno was transported to Tobago in 1659 and left there to their devices. Another 152 Livorno Jews were on the way to Cayenne in 1660 but reached Tobago and were forced to stay there. Their further fate is unclear (Arbell, 1993).

Meanwhile, the Courland colony did not fare well. By 1658, a large percentage of the original colonists had succumbed to tropical diseases and climate, a smaller number had been killed in Carib attacks, and the rest were generally unhappy. Commander Clottring had died and the Lutheran pastor Engelbrecht had fled back to Courland, citing his disappointment with the colony life and work (Matthiesen, 1940). In the same year, Sweden invaded the Duchy of Courland. On October 10, 1658, the Duke and his family were placed under arrest. Courland ships were impounded in European ports or stranded overseas, and no provisions were reaching Tobago.

After receiving the news from Europe, the Dutch had been instigating a mutiny at Fort Jacob. In November 1659, the commander of the Courlander garrison with ten of his men, believing the rumors that they had been forgotten and left to starve on the island,

surrendered to the Dutch governor Hubert van Beveren and requested to be transported back to Europe. Representatives of the Lampsins company took over Fort Jacob on December 11, 1659. The Dutch preferred to stay on their side of the island, with only a small force stationed at Fort Jacob. By the time Duke Jacob was able to recover from the war and send an expedition to reclaim the colony, the fort had been abandoned and looted. Courland's Gambia colony was similarly isolated and opportunistically attacked by the Dutch. However, it held on until 1661 when its governor was forced to hand the fort over to the British (Kenins, 2014).

Post-1660 Tobago: conflict and abandonment

Much of the literature on the later years of the Courland colony and 17th-century Tobago in general appears to be pure speculation, based on promotional texts, such as Charles de Rochefort's *Histoire Naturelle et Morale des Iles Antilles* and John Poyntz's *The present prospect of the famous and fertile island of Tobago with a description of the situation, growth, fertility and manufacture of the said island, to which is added proposals for the encouragement of all those that are minded to settle there*, a pamphlet written in 1683 to entice investors, painting an unrealistic picture of a paradise island, where an investment of only one hundred pounds sterling will yield you three thousand pounds in just five years. In reality, the next few expeditions from Courland had little success re-establishing a permanent presence on Tobago.

Following the Oliva peace treaty on May 3, 1660, Duke Jacob was freed from captivity, and his rule was restored. After the war, the economy of Courland was in ruins.

Reclaiming the overseas colonies was far from a priority for the Duke who had to rebuild his fleet and restore diplomatic relations with other European powers. In November 1664, King Charles II of England signed a deal with Duke Jacob, recognizing his rights to the Tobago colony, in exchange for the Gambia (Kenins, 2014). The Dutch were notified about this development but were unwilling to concede their hold on Tobago and requested help from the King of France. Cornelis Lampsins paid the French monarch a large sum of money for the title of Baron of Tobago, however little practical assistance to the colony followed this gesture. During the 1660s and 1670s, Tobago was almost constantly fought over by the Dutch, the English, and the French.

In 1666, during the Second Anglo-Dutch War, Lampsinsstad was raided by Jamaican buccaneers. The town was plundered and abandoned. The English had stationed a small garrison of fifty men at Fort Jacob. It was then overrun by an even smaller French force of twenty-five, who captured the English commander by deceit and forced a surrender. The French held the fort until 1667 when they withdrew and set it on fire (Woodcock, 1867). The Dutch resettled Lampsinsstad in 1668, however, in the Third Anglo-Dutch War, the French sided with the English and destroyed the Dutch colony once again. After the 1674 Peace of Westminster, the Dutch returned to Tobago. Admiral Binckes was sent to restore the colony and built a new fort, Sterreschans, near Lampsinsstad. In 1677, it was the site of a major naval battle, known as the Rockley Bay Battle, between Binckes' fleet and the French fleet of Count d'Estrées. The death toll on both sides was in

hundreds, including two ships of Dutch civilians and slaves. In December, d'Estrées returned and with a lucky shot blew up the fort magazine, killing Binckes and nearly all officers. The French captured several hundred survivors and looted and burned the Dutch plantations. The Dutch presence on Tobago had ended.

The first post-war Courlander ship was dispatched to Tobago in 1668. Along the way, a conflict arose between the captain and the commander of the expedition, and the ship returned to Windau. Another unsuccessful voyage in the 1670s was captured by pirates before reaching the destination. Finally, a group of colonists led by English Lieutenant Bennet came ashore in 1680. They found Fort Jacob in ruins and, instead of repairing it, built a small fortification at Stone Haven Bay. The second group of colonists, led by Colonel Monck, was delayed and arrived a year later in 1681. By then, Bennet had given up and left for Barbados. The colony of several hundred settlers and soldiers was off to a good start and renewed shipments of produce. However, Monck defied Duke Jacob's directive to maintain peace with the local populations and began attacks on Amerindian settlements. As a result, the colony came under constant retaliatory attacks from Caribs who received support from French buccaneers. Monck abandoned the colony after twenty-two months and was arrested upon his return to Courland (Kenins, 2014).

Duke Jacob died on December 31, 1681. His heir, Duke Friedrich Casimir had little interest in overseas colonies. In an attempt to profit from Tobago, he negotiated with an English merchant Captain John Poyntz to settle the island with English families. Poyntz allegedly visited Tobago and published the previously mentioned pamphlet, portraying Tobago as a flourishing colony, with several large towns and a population numbering in

the tens of thousands. This scam was ended by the English Crown in 1683 when Poyntz was ordered to cease all activities (Boomert, 2015).

The final Courlander attempt to resettle Tobago was made in June 1686 by Captain Schmoll who was ordered to rebuilt Monck's fortifications and restore trade. The endeavor was hindered by tropical storms and a disease epidemic, which by spring 1687 had killed a third of the colonists. Schmoll deserted the colony in March 1687 and was sentenced to death in absence, but he avoided capture. A supply ship with a new colony governor, Alten-Bockum, arrived in October 1687. Unfortunately, the ship was wrecked on cliffs in a storm and Alten-Bockum died from injuries before stepping ashore. No further ships were sent to Tobago from Courland (Kenins, 2014).

While it is hard to say how many settlers remained behind and how many of them left the island for Barbados and other colonies, the description of Tobago as uninhabited in the following decades is highly inaccurate. The Kali'na population numbered in the hundreds and had several large villages of fifty or more houses. Both the Dutch and the Courlanders had established good relations and regularly traded with the Kali'na. It is likely that European settlements outside the forts persisted over a longer time and into the 18th century, rather than appearing and disappearing between each subsequent shipment of colonists. The use of Courlander place names also demonstrates the continuity of European occupation of the island. The last known information on Courlanders on Tobago comes from a Danish captain in 1693. He met a group of settlers who had not seen a European ship in six years and had stockpiled a large amount of produce for shipment (Anderson, 1970). The island was also frequented by Spanish and

French turtlers and Barbadian woodcutters. However, no major European power officially reclaimed Tobago until 1763, when following the Seven Years' War, France ceded it to Britain.

The British Era

After the 1763 Paris Treaty confirmed the English claim on Tobago, a proclamation by King George III formed the colonial government of Grenada which included the islands of Tobago, St. Vincent, the Grenadines, and Dominica. The first British lieutenant-governor, Brown, arrived on Tobago in 1764. The island was surveyed and divided into lots, which were put up for sale. Exceptions were made for the forested Main Ridge, which was kept untouched as a Crown reserve, areas set aside for the founding of a town in each parish, and the Amerindian villages. The 1775 Thomas Jefferys' map of the Great and Little Courland Bays, surveyed by David Ross, marks the location of Fort Jacob as "Remains of a Fort", and a site on Stone Haven Bay as "Remains of a Fort & House in the Dutch Taste", which is most likely the settlement of the 1680s Bennet, Monck, and Schmoll's expeditions. Jefferys' map also shows a 1764 settlement on the Belle Island and barracks and a guard house at the location of the later Fort James, in the area marked for the development of Plymouth Town. The first land grant, sold to James Simpson on March 20, 1766, was Lot 1, containing 500 acres located at Courland Bay (Woodcock, 1867). Thus, the location of the first European plantation on Tobago became the first British sugar estate.

Sugar mill construction

By the mid-17th century, when Courland colonists arrived on Tobago, sugar cane had been cultivated in the West Indies for over 100 years. The Dutch began sugar production in Brazil in the early 17th century, and the British colony on Barbados had sugar mills by the 1640s (Ligon, 1657/2014). While it is unclear whether any of the Courlanders had firsthand experience with the construction of sugar mills, they most likely followed Dutch and English instructions, like those found in Ligon's 1657 text *A True and Exact History of the Island of Barbados*. Richard Ligon was a British investor who lived on Barbados and recorded his observations between 1647 and 1650.

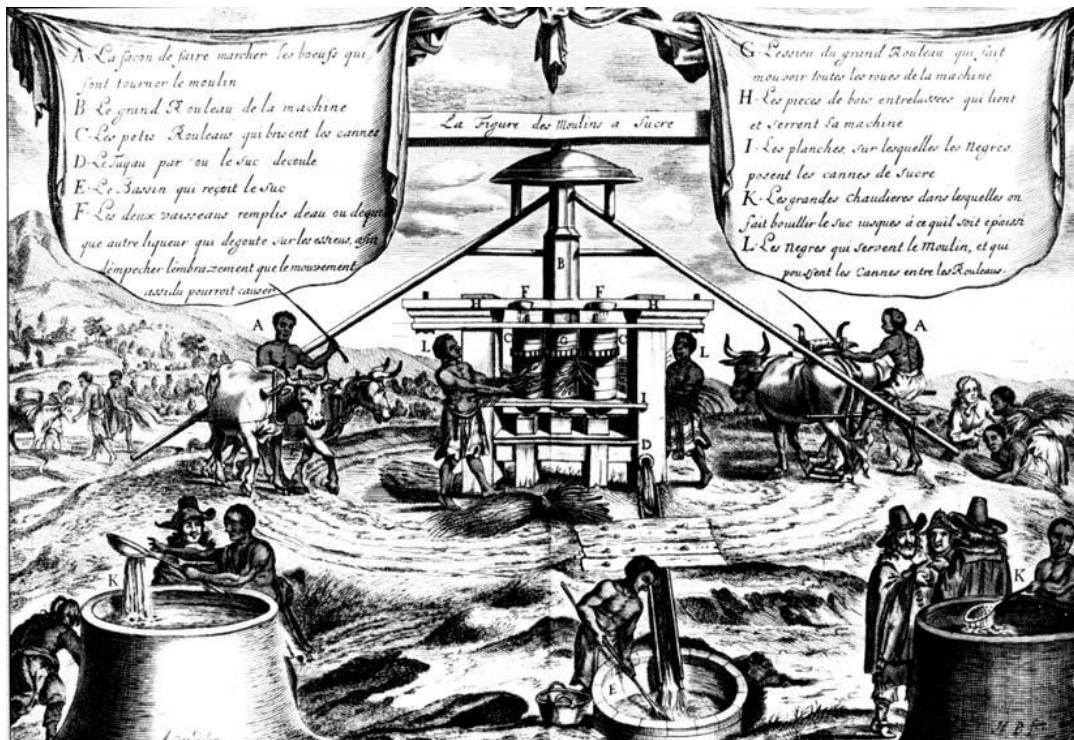


Figure 3: Illustration of an animal-powered sugar mill from Charles de Rochefort's *Histoire morale des Iles Antilles de l'Amérique* (1667)

All Tobago mills at first were animal powered. Ligon recommends placing the animal-powered crushing house on a flat hill, 80 ft (24 m) in diameter, with the boiling house on a slope 4.5 ft (1.4 m) below the mill level, connected with a pipe to transfer the cane juice. Ligon's crushing mill is circular, 40 ft (12 m) in diameter, with a rectangular center feature, and enclosed in a square timber structure. According to Meide (2003), the average diameter of an animal-powered crushing mill in the West Indies is 16.7 m. The Courlander mill was likely a small, open structure with one furnace and one cooling tank, with a rum distillery next to the boiling house, similar to de Rochefort's and du Tertre's illustrations (Figures 3 and 4).



Figure 4: A sugar mill in the French West Indies

From du Tertre's *Histoire générale des Antilles habitées par les Francois*, ca. 1667 (Meide, 2003). An open boiling house is in the center, with a rum still to its left. A crushing mill is seen in the background on the right.

Previous archaeological research

Archaeological research of the Tobago colonial period has been scarce. This is a part of the history that the locals would rather not talk about because of the painful reminders of slavery, and there is little interest in the preservation of the remains of early colonial buildings. To this date, no excavations have taken place on the site of Fort Jacob.

The Latvian-American historian Dr. Edgar Anderson, who is considered an undisputed authority on the history of the Duchy of Courland and its colonies in the West Indies, has been the only researcher so far to conduct ground and aerial survey of sites directly related to the Courland colony. Formally organized by the government of Trinidad and Tobago, the 1960 survey, divided into archaeological, historical, archival, and informational sections, was intended to identify and create an inventory of historical and archaeological sites on both islands and collect materials for informational brochures, textbooks, and signage. Anderson and Tom Cambridge directed the history team. The archaeological team was led by John Bullbrook. The newspapers *Trinidad Guardian* and *Trinidad Chronicle* ran a series of articles on Anderson's expedition in 1959 and 1960. A survey report was not published, and I have not been able to locate any documentation pertaining to this project.

In May 1987, a Tobago archaeological-historical survey was conducted by Boomert, Ortiz-Toncoso, and van Regteren as a joint project of the University of the West Indies and the University of Amsterdam, in cooperation with the Tobago House of Assembly. The ground survey resulted in an inventory of 62 sites, mainly concentrating on the identification of Dutch colonial period sites (Boomert et al., 1987).

Two archaeologists have conducted surveys and subsurface testing at the Courland Estate. Eubanks conducted a limited survey and testing at the site of the 19th-century sugar factory complex as part of a property development plan for Laughlin and Associates in 1989 (Clement, 1995). Clement's comprehensive work on the archaeology of sugar plantations on Tobago for his Ph.D. dissertation in 1995 located and described twenty remains of sugar estates, including factories, estate houses, and estate villages, in St. David's Parish. Courland Estate was one of the three sites selected for an intensive survey. This research was limited to the post-1763 British era and did not attempt to locate earlier settlements. In an area identified from subsurface structural remains as the estate village, shovel testing found 677 artifacts. Among them were European ceramics and locally manufactured unglazed coarse earthenware (Clement, 1995). While the majority of the ceramic sherds date to the British era, at least one artifact, a Bellarmine jug fragment, is an indication of an earlier, 17th-century occupation of the site. Bellarmine or Bartmann stoneware jugs were produced in the Rhineland region of Germany in the 16th and the first half of the 17th centuries (Wilcoxon, 1987).

METHODS

Methodology literature review

Of the various GIS applications in archaeology, the ones used in this research are satellite remote sensing, Lidar, aerial photography imagery, predictive modeling, and viewshed analysis. A viewshed is an area visible from a location, comprising all points that are in a line of sight. Viewshed analysis uses a digital elevation model (DEM) and creates a binary map of cells classified as either visible or nonvisible from an observer point. However, visibility is not always as unambiguous, and factors other than elevation can affect its interpretation. Over time, the understanding of visibility has evolved from a physical attribute of the environment to a culturally affected human experience (Wheatley & Gillings, 2000).

Early studies of non-binary viewshed analysis include Fisher's fuzzy viewshed concept (1992) created by adding simulated error to the DEM and indicating the percentage of probability of a cell being visible or invisible. Loots et al. (1999) use projective and reflective types of fuzzy viewshed to explore the intervisibility of a Hellenistic watchtower system. Wheatley and Gillings (2000) review criticisms and issues of visibility-based methods in archaeology and offer a solution based on the Higuchi viewshed dividing the view into three distance bands. Zamora (2005) compares total and cumulative viewsheds as alternative applications of the Viewshed tool in ArcGIS. Ruestes (2008) explores various techniques of visibility analysis, which improve on the traditional binary viewshed method. In order to obtain a more accurate representation

of visible areas, multiple viewer points are combined with probable viewsheds, taking into account reduction of visibility with increasing distance from the observer point.

Fry et al. (2004) combine GIS models on two scales to identify high probability zones of cultural heritage interest. The regional prediction model takes into account resource availability, land cover, soil maps, and convexity of slopes. The landscape level model correlates fieldwork-based visual analysis and GIS-based viewshed analysis, identifying visual barriers delimiting landscape units. The main benefit of a GIS viewshed is the ability to explore different scenarios of land use and vegetation cover. Visual analysis, on the other hand, allows for interpretation of the cultural significance of landscape features.

In studies on the use of GIS in human landscape research in archaeology, Llobera (1996, 2001) proposes an interdisciplinary approach to GIS in archaeology, incorporating disciplines such as ecological psychology and urban design, and illustrates the potential of GIS in creating a landscape narrative surpassing the traditional quantitative maps. The topographic prominence of terrain from an individual's point of view is used as an example of the role of landscape in social processes. Richards-Rissetto (2017) also addresses the criticisms of GIS in archaeology as environmentally deterministic and separated from the human experience. Semiotics is proposed as the theoretical framework to link GIS data and the culturally constructed meaning of the landscape.

Von Schwerin et al. (2013) introduce 3D WebGIS as the link between data and human experience. This platform, used in the MayaArch3D project, merges GIS, 3D modeling, remote sensing, photogrammetry, and virtual reality, allowing researchers to analyze

archaeological data in a geographically referenced virtual environment. Dell'Unto et al. (2016) call attention to a problem with the use of the 3D WebGIS platform in everyday archaeology, namely, the complexity of data implementation requiring input from computer science and IT professionals and suggest alternative approaches. In the Swedish Pompeii Project, they utilize georeferenced, textured 3D models, acquired by laser scanning and photogrammetry, within a 3D GIS data model.

GIS has been traditionally used for but is not limited to quantitative spatial data. Geographic text analysis is a new, interdisciplinary approach to historical archaeology via GIS methods (Murietta-Flores & Gregory, 2015), and its potential is growing with the availability of digital texts and geoparsing software. In an example of predictive location modeling, Hewitt (2016) uses a GIS model based on quantitative and qualitative historical data to locate the site of the Battle of Hastings, 1066. Three alternative sites have been proposed by historians, along with the traditional site of Battle Hill near the Battle Abbey. Hewitt analyzed English, Norman, and Anglo-Norman textual sources from the 11th-12th centuries for location descriptors and the frequency of their appearance in the texts. Elevation, slope, and historical land use maps were used to classify the landscape. Weighed variables were applied to the map to assess the low or high degree of fit with the battle location criteria. Both Battle Hill and one additional site were confirmed as possible sites of the battle.

The review of the various methods used in landscape analysis and site location emphasizes the importance of combining multiple, interdisciplinary approaches to fully understand the human experience and factors affecting the choices of site placement.

Datasets and data types

The types of data used in this thesis can be divided into the primary and secondary historical sources and the modern GIS datasets. The primary historical sources are further categorized into textual documents and maps or drawings (Table 1). The main secondary source was archival research by multiple authors (Matthiesen, 1940, Anderson, 1970, Kenins, 2014, and others) into firsthand reports, letters, shipping manifests, and legal documents pertaining to the Duchy of Courland and Tobago.

20th-century maps, used in this research and available as digital images, include Tobago topographic map 1: 50,000 (Latham, 1926), Tobago tactical map (U.S. Army Corps of Engineers, 1940), and Tobago nautical map (Defense Mapping Agency, 1995). Datasets of Tobago land cover, Inventory of the Indigenous Forest of Tobago (2012), are available as raster images from USDA Forest Service. The Geospatial Information Portal for Tobago provides several datasets as ArcGIS layers, namely aerial photos (1994 and 2014), Lidar hillshade, planimetric maps, and satellite imagery (2007).

Table 1. Available historical maps of Tobago.

Title	Author	Year
Reja en la Ysla de Tabago	unknown	1600s
Bird's eye view of the bay and the fort of Nieuw Vlissingen on Tobago	Johannes Vingboons	1665
Afbeeldingh Der heer rescontrete Water en te Lant op het Eylandt Tabago, Tusschen den Fransen Admirael d'Estrée, en den Heer Commandeur Binckes	Romein de Hooghe	1677
The Island of Tobago	John Seller	1682
Map of Tobago Showing Native Dwellings	unknown	1756
A new map of the island of Tobago shewing all the rocks, shoals and soundings Engraved from an actual survey by Thos. Kitchin	Thomas Kitchin	1771
Tobago from actual surveys and observations	Thomas Jefferys	1775
Plan of the island of Tobago, laid down by actual survey under the direction of the Honorable the Commissioners for the Sale of Lands in the Ceded Island by John Byres Chief Surveyor	John Byres	1776
A map of the island of Tobago	Thomas Bowens	1778
Carta esférica de la Ysla de Tabago	unknown	1793
Map of the island of Tobago for the History of the West Indies by Bryan Edwards Esqr	Bryan Edwards	1799
Grand Courland Bay, Tobago	Wm. Elliott	1818
Tobago, particulars of a valuable Sugar Estate known as "Courland," in the parishes of St. David and St. Patrick, in the Island of Tobago, containing 860 acres, or thereabouts, together with the buildings, fixtures, machinery, & live & dead stock thereon : which will be sold by auction, in one lot, by Messrs. Hards, Vaughan & Jenkinson, before James Fleming, Esq. Q.C., and Reginald John Cust, Esq., Commissioners for sale of Incumbered Estates, in the West Indies, at the Sale Room of the Commissioners	Hards, Vaughan, & Jenkinson	1879

Stage one: mapping the fort

Determining the location of Fort Jacob was the goal of the first stage of this research. Viewshed analysis and predictive modeling in the second stage rely on observer points at the fort and distance from this reference point. The most recent cartographic record of the 17th-century fort is the previously mentioned 1775 Jefferys' map on which the fort ruins are clearly separate from the site of the later British Fort James. Both Mollens' map and the anonymous 17th-century Spanish map place the fort on a cliff where the Courland River flows into the Great Courland Bay. Satellite, aerial, and Lidar images were examined in Google Maps and ArcGIS for evidence of structures in this location. The outline of the fort was drawn in ArcGIS from the 1654 plan and superimposed on the Lidar image to match the scale and rotation of the located structure (Figure 5).

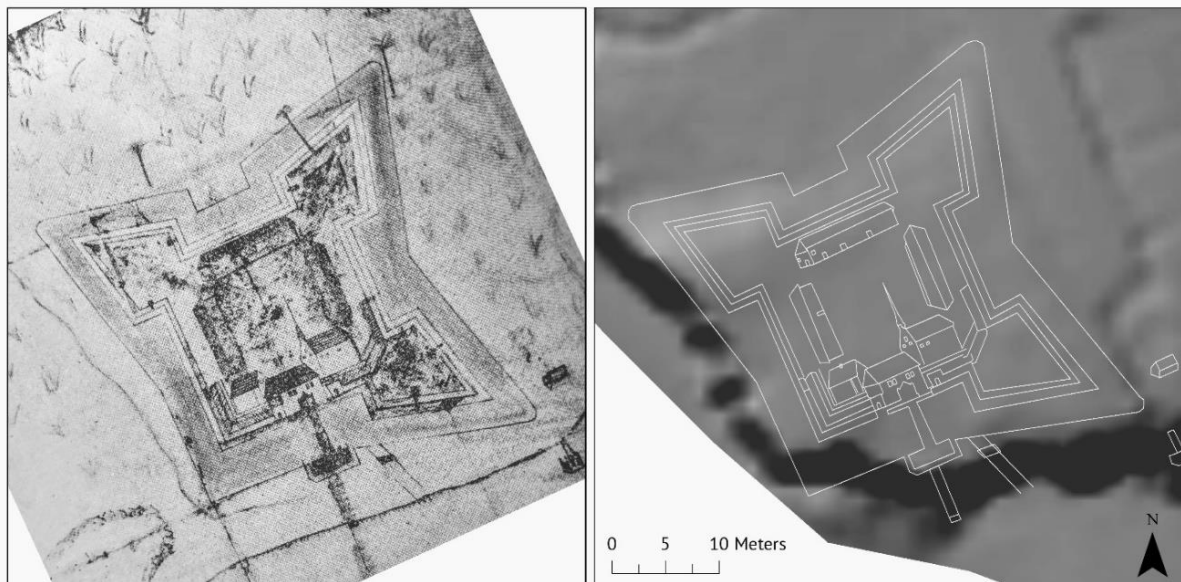


Figure 5: Plan and outline of Fort Jacob

Left: the 1654 Mollens' plan of Fort Jacob, rotated. Right: outline of the fort superimposed on the Lidar image.

Stage two: Predictive sugar mill location model

The only physical link to a 17th-century settlement at the Courland Estate is the Bellarmine jug sherd found during subsurface testing (Clement, 1995). The excavation uncovered foundations of several structures which were used as housing for slaves who worked at the sugar factory. Remains of the 18th-century estate house are located nearby as well as a number of other structures of unknown purpose (Figure 6). In the 19th century, the old estate house was abandoned, and a new one was built to the northwest, near the sugar factory and windmill towers. The layout of the 19th-century sugar works is shown in the 1879 Courland Estate sale plan. Considering the amount of work and building materials required for the construction of a mill, it is reasonable to assume that, after taking the ownership of the estate in the 18th century, the British settlers reused the structures of the 17th-century Courland plantation and mill. There are no maps or textual descriptions indicating where precisely the Courland settlers built their farms. A settlement by itself could be placed nearly anywhere within a short traveling distance from the fort unless it housed sugar mill workers, in which case it can be expected to be in close vicinity to the mill. A sugar mill is easier to locate since it must adhere to several criteria. A predictive location model was created in ArcGIS with these parameters to determine whether the site of the 18th-century British sugar mill is a potential location of a 17th-century sugar mill.

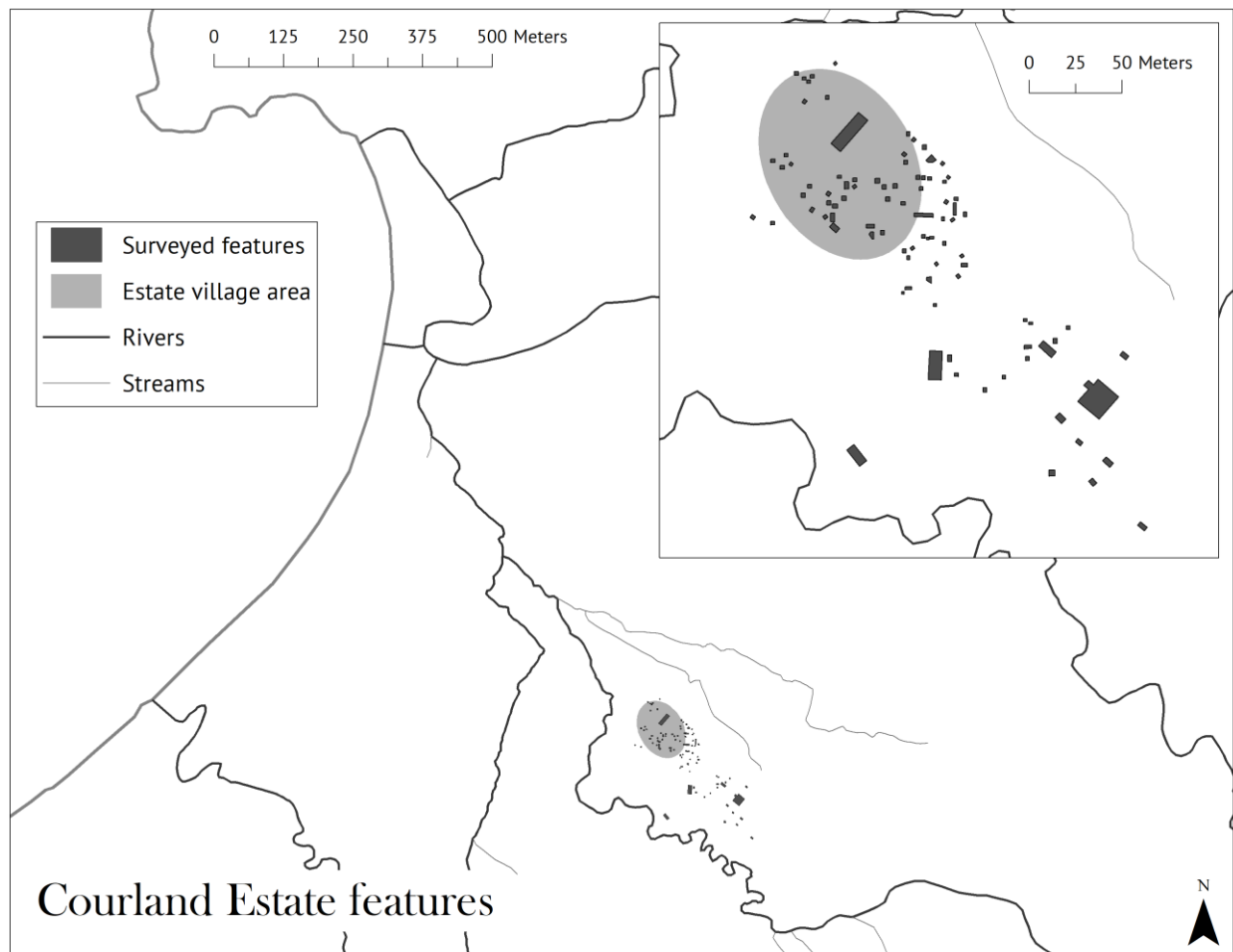


Figure 6: Features surveyed on Courland Estate

Drawn from a map by Clement (1995). The highlighted estate village area is where the 17th-century Bellarmine jug sherd was found.

First of all, the construction and operation of a sugar mill and a rum distillery required a large financial investment. It would have been beyond the means of most settlers. The plantation owned by the wealthy Duke of Courland, therefore, is the most likely candidate for this mill. The approximate location of the Courland Plantation, according

to textual sources (Anderson, 1970), is within the 18th-century boundaries of the Courland Estate.

The sugar mill had to be visible from the fort, and vice versa, for defense purposes. An officer on watch at the fort would be able to observe the mill location and roads leading to it to ensure safety and dispatch soldiers in the event of trouble. A fort is a large structure, not a single point. Therefore multiple observer points were used to simulate observers viewing the surrounding landscape from different vantage points within the fort.

Visibility analysis requires the input of a digital elevation model (DEM), a raster representation of the terrain elevation data. Currently the most precise global DEM, available free of charge, is the Japan Aerospace Exploration Agency (JAXA) AW3D30 dataset with a 30-meter (1 arc second) horizontal resolution, based on a 5-meter mesh, and 5-meter height accuracy. NASA Shuttle Radar Topography Mission (SRTM) Version 3.0 Global 1 arc second dataset is also available as a free download. An alternative way to create a DEM is from digitized elevation contours from a topographic map. The Topo to Raster tool in ArcGIS can create a raster surface from point, line, and polygon data. Depending on point density, it can result in a more accurate DEM than the 1 arc second datasets and is capable of displaying features such as cliffs, streams, and coastlines. After comparing the DEM created from topographic contours and the DEM from the AW3D30 dataset, the latter had a more consistent overall accuracy and was used for visibility analysis (Figure 7).

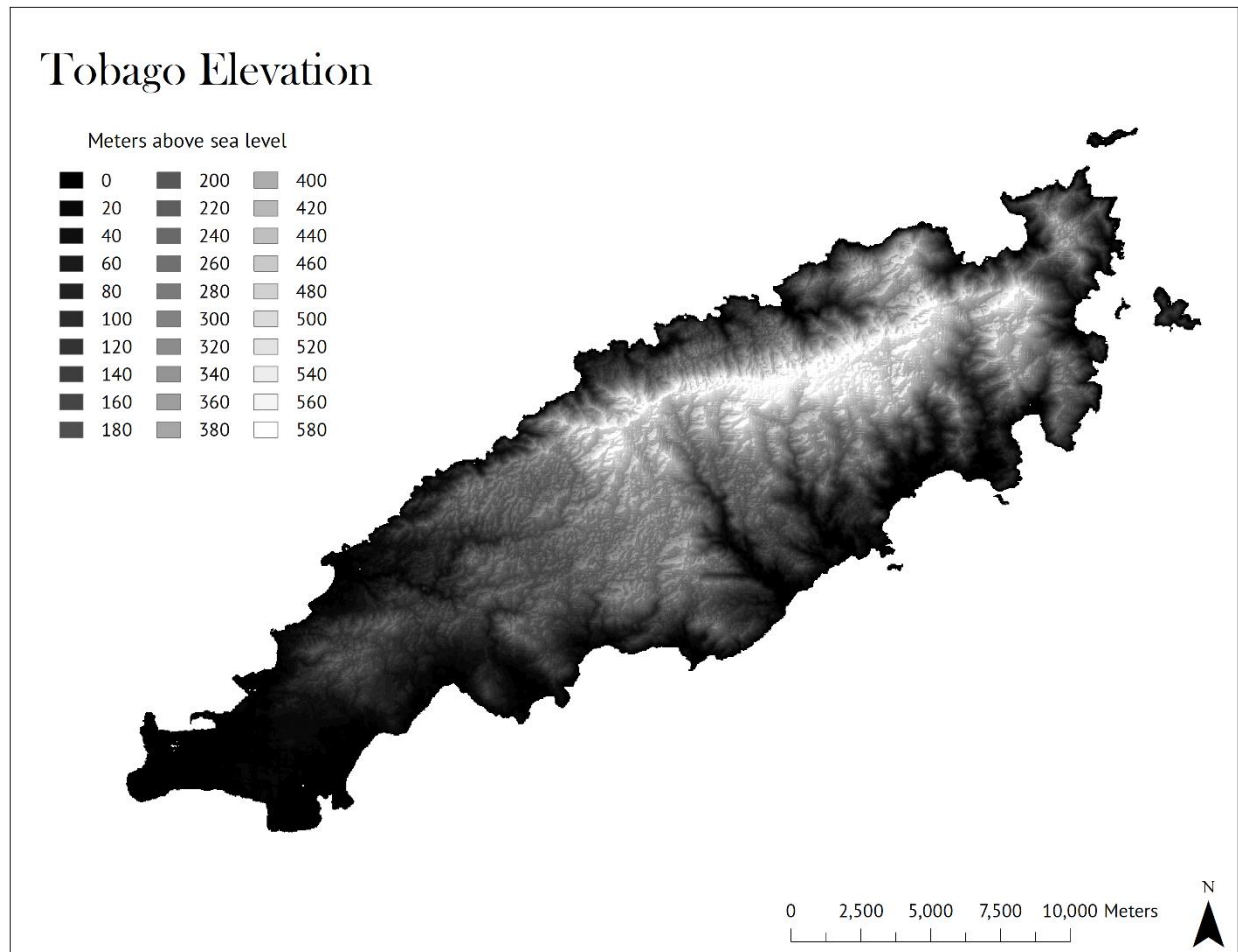


Figure 7: Tobago digital elevation model from JAXA AW3D30 dataset

The Visibility tool in ArcGIS determines which surface raster cells are visible to a set of observer points. Ten observer points were selected within the fort to simulate a person standing atop the bastions (Figure 8). I deliberated adding a tree canopy height raster to the elevation raster to simulate visibility with tree cover. A Tobago land cover raster is available from USDA Forest Service, which could be used for this purpose. However, the current vegetation type of the study area is predominantly new growth forest and agricultural land, which may not correctly reflect the land cover in the 17th century.

Large-scale deforestation is also expected when preparing land for sugar cane plantations. Due to these considerations, I did not use the land cover raster for visibility analysis. The resulting visibility raster (Figure 9) displays the raster cells visible from the observer points at the fort and the number of points from which each cell is visible.

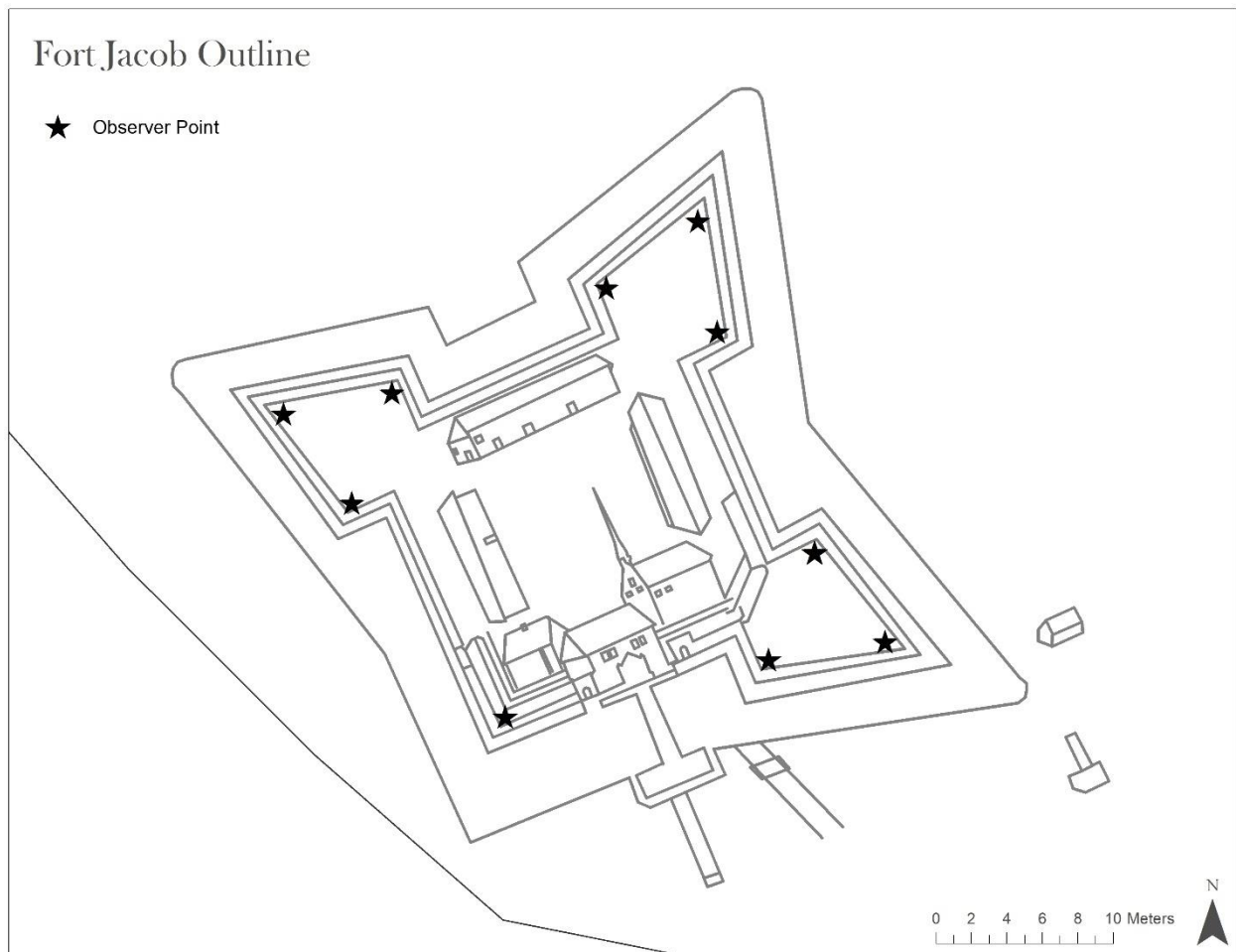


Figure 8: Observer points for visibility analysis

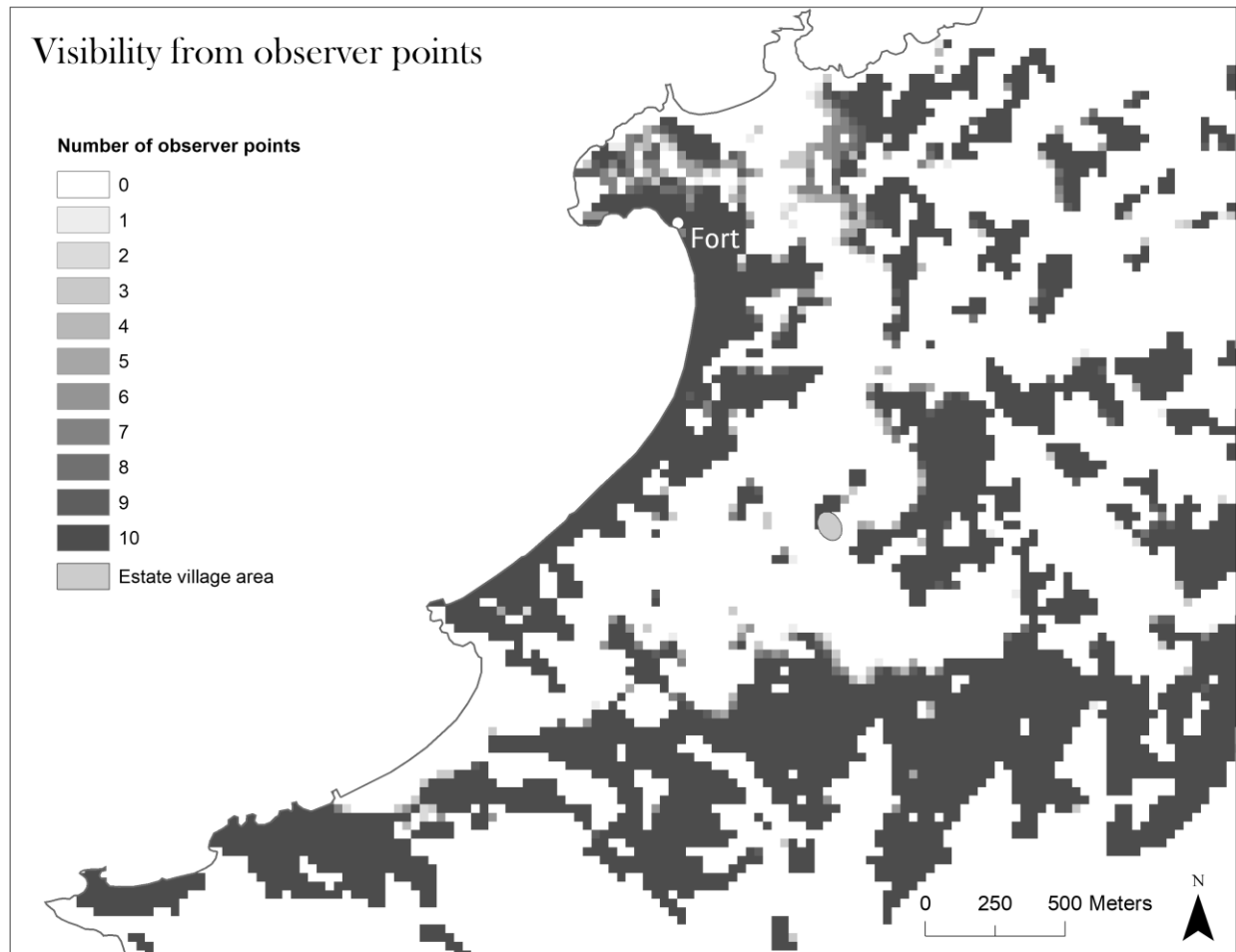


Figure 9: Visibility from the fort

Cell value represents the number of observers to which it is visible.

The next parameter of a sugar mill location is its distance from the fort and its warehouses where sugar was stored before shipping. Heavy carts loaded with raw sugar were pulled by oxen. While oxen can pull heavier weights than horses, they can travel only for up to five hours a day, at a speed of 2-4 km/h (FAO, 1993). Considering that the cart had to make a return trip, at the lowest speed, it limited the travel time to 2.5 hours in one direction or a catchment area within 5 km from the fort. To perform proximity

analysis, the Buffer tool was used to create a 5 km distance buffer around the point representing the fort. The Slope tool was used with the DEM to create a percent slope raster, which was reclassified to represent the cost of traveling across each cell, with steeper slope equaling higher cost, on a scale from 1 to 10. The rivers shapefile was converted to raster and reclassified with value 5 for river cells and 0 for all other cells. Both rasters were combined to create a cost surface raster, which then was used with the Cost Distance tool to identify the least accumulative cost of traveling across the terrain for each cell within the 5 km radius around the fort (Figure 10).

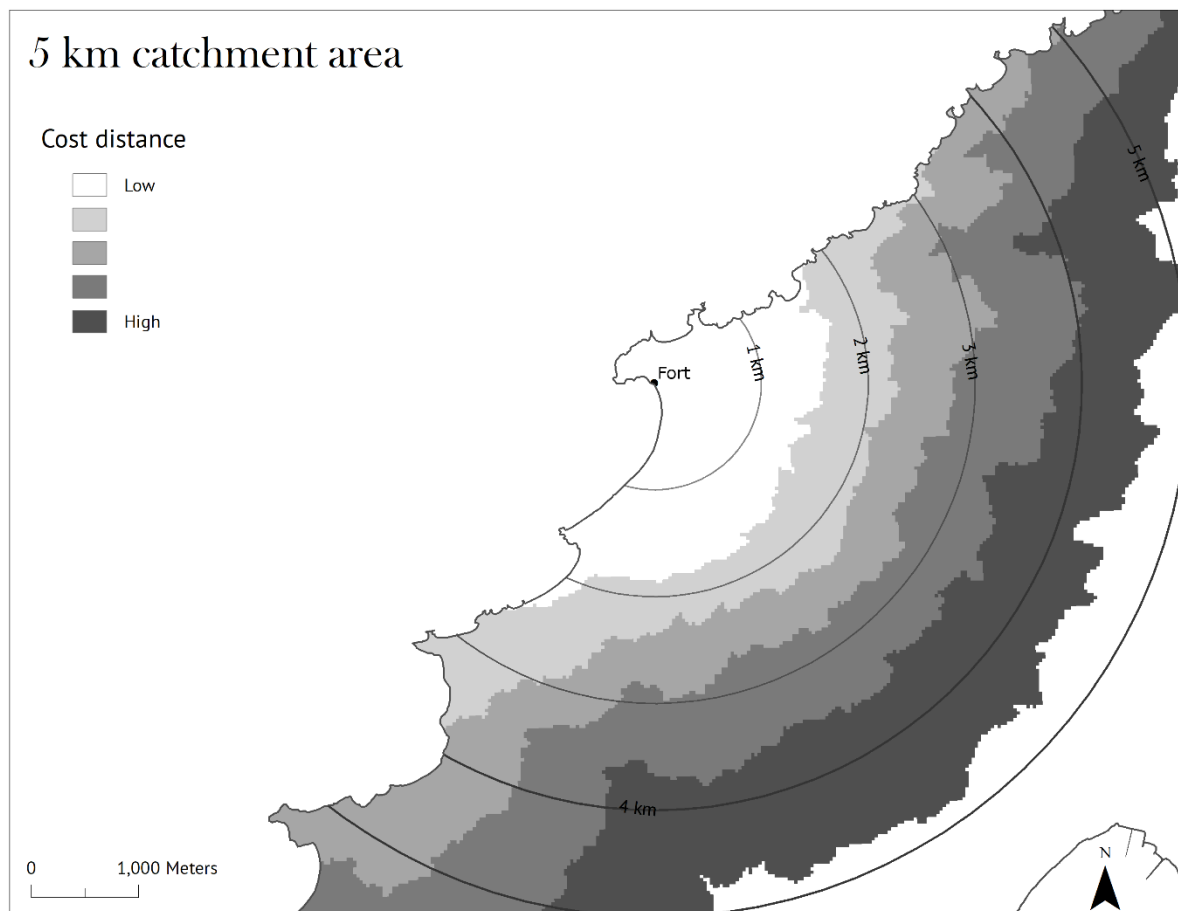


Figure 10: 5 km catchment area around the fort with cost distance

Finally, the sugar mill had to be located in close proximity to a freshwater source, because sugar and rum production required large amounts of water, as both drinking water for animals and mill workers in the hot climate and water used in the rum distillery (Meide, 2003). Courland Estate has two perennial spring-fed freshwater streams in addition to the Courland River. The northernmost stream supported one or two water wheels in the 19th century (Clement, 1995). Other waterways in the area are seasonal and mostly dry. To create a detailed shapefile of Tobago waterways, I digitized a topographic map of the area of study (Latham, 1926) in ArcGIS, then cross-referenced it with Lidar imagery to redraw waterways. Due to the high volume of data, I limited the extent to the approximate area of the Courland colony.

The Buffer tool was used to create 25, 50, 75, and 100-meter corridors around all perennial waterways (Figure 11). There is no data on practical distance limits to freshwater source in the construction of animal-powered mills in the 17th century beyond the descriptive “very close by”, therefore the arbitrary 100 m distance was selected.

The predictive location model combines the values of the visibility, cost distance, and waterway buffer rasters, each reclassified on a 0-10 scale. The waterway buffer raster was reclassified with cell values between 0-10, with higher values at a closer distance, and a 0 value outside the 100 m boundary. The cost distance raster was reclassified with values 0-10, with the highest value for the lowest cost distance. The visibility raster value is the observer count for each cell. The three raster values were added with the

Plus tool. The Raster Calculator tool was used to convert numerical values to a percentage out of the maximum possible value of 30.

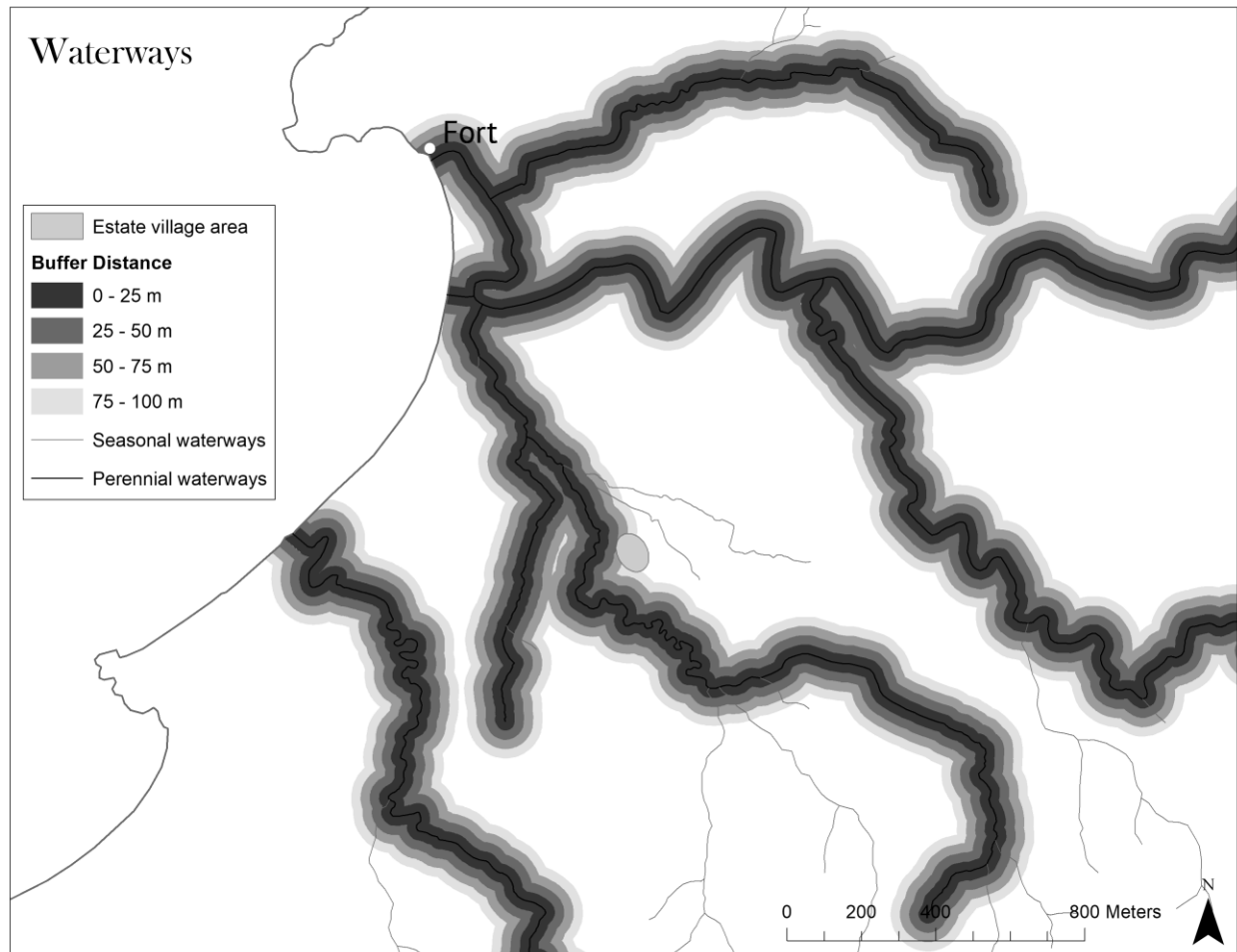


Figure 11: Perennial and seasonal waterways and buffer corridors

RESULTS AND DISCUSSION

Part one: fort

A comparison of 17th-century maps, plans, and descriptions with modern maps and satellite images of the area confirms that Courlanders reused the existing 1630s Dutch Fort Nieuw Vlissingen for their Fort Jacob. The speed of construction, resulting in a complete fortification by at least October 1654, implies that most of the structures were still in place when Mollens' expedition arrived. Examination of satellite and aerial images shows that the location of the 17th-century fort is currently an empty field with no structures, except for the 1978 Courland Monument. However, a Lidar imagery layer from ArcGIS Online reveals a subsurface structure, which when enhanced in GIMP with the image sharpening filter Unsharp Mask (USM) to increase contrast by sharpening the edges, corresponds to the shape of a fortification with three bastions (Figure 12). When overlaid with the outline of Fort Jacob from the 1654 plan, the shape of the structure closely matches the size and the locations of the bastions. No interior structures can be discerned on the image. If a subsurface survey were conducted on the site of Fort Jacob, the evidence of at least two phases of construction, the 1630s Dutch and the 1650s Courlander, as well as the 1667 burning of the fort by the French could be expected to be found.

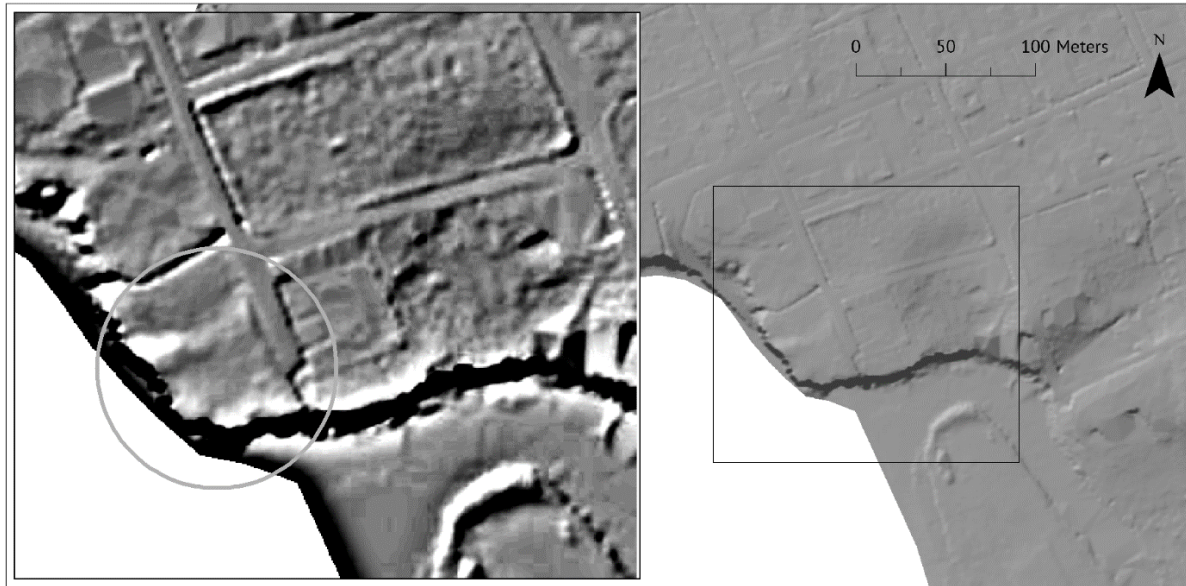


Figure 12: Lidar image of the fort area

Source: GeoSpatial Information Portal for Tobago. Left: the same Lidar image enlarged and enhanced in GIMP. The circle marks the fort.

The combination of the fact that no structures remain above the ground and the absence of the fort from post-1770s maps imply that the remains of the fort were further destroyed during the construction of the Plymouth town or the British fort. The Plymouth Health Center building (Figure 13) incorporates a coral block wall with bullet holes, which according to the local lore is a part of the 17th-century fortification. However, it is too far from the fort walls, so it either belonged to a different structure, such as a warehouse, or the building blocks were removed from the fort and reused during the construction in the 18th or 19th century. Considering the scarcity of building materials and the tradition of reuse of older structures on the island, I suggest that the British Fort James, the construction of which began in 1764, was at least partially built

from the coral blocks of the nearby remains of Fort Jacob, which explains the disappearance of the latter.



Figure 13: Fort Jacob 1654 outline overlaid on the aerial imagery of Plymouth, with the Courland Monument in the center of the fort

Part two: sugar mill

To determine whether the 18th-century Courland Estate village was a possible location of a 17th-century sugar mill, a predictive location model was created based on three requirements: visibility, distance from the fort, and proximity to a freshwater source. The resulting raster (Figure 14) shows for each cell the percentage by which it matches the conditions of an ideal sugar mill site location. The white areas represent the highest probability of a site location. The NW side of the 18th-century sugar estate area lies within a high probability area, as well as a fraction of the SE side, including the remains of the 18th-century estate house. The predictive location model provides sufficient evidence to positively answer the research question whether the site on Courland Estate where the 17th-century Bellarmine jug sherd was found was a suitable location for the Courlander settlers to place a sugar mill.

It has to be noted that, while this model shows the probability that a location is theoretically suitable for construction of an animal-powered sugar mill in the 17th century, it does not imply the existence of such sites. Likewise, the presence of 17th-century artifacts on Courland Estate does not in any way identify it as a sugar mill. Several alternative possibilities exist. Firstly, the site could be a location of a Dutch settlement in the 1630s and not be resettled by Courland colonists (Figure 15). Secondly, it could be a site of a village or a plantation but not contain a sugar mill. Thirdly, the 17th-century artifacts could have been relocated from another site to the 18th-century village. Other factors, not included in the predictive model, can affect the choice of a sugar mill site, including land cover and soil quality for growing sugar cane.

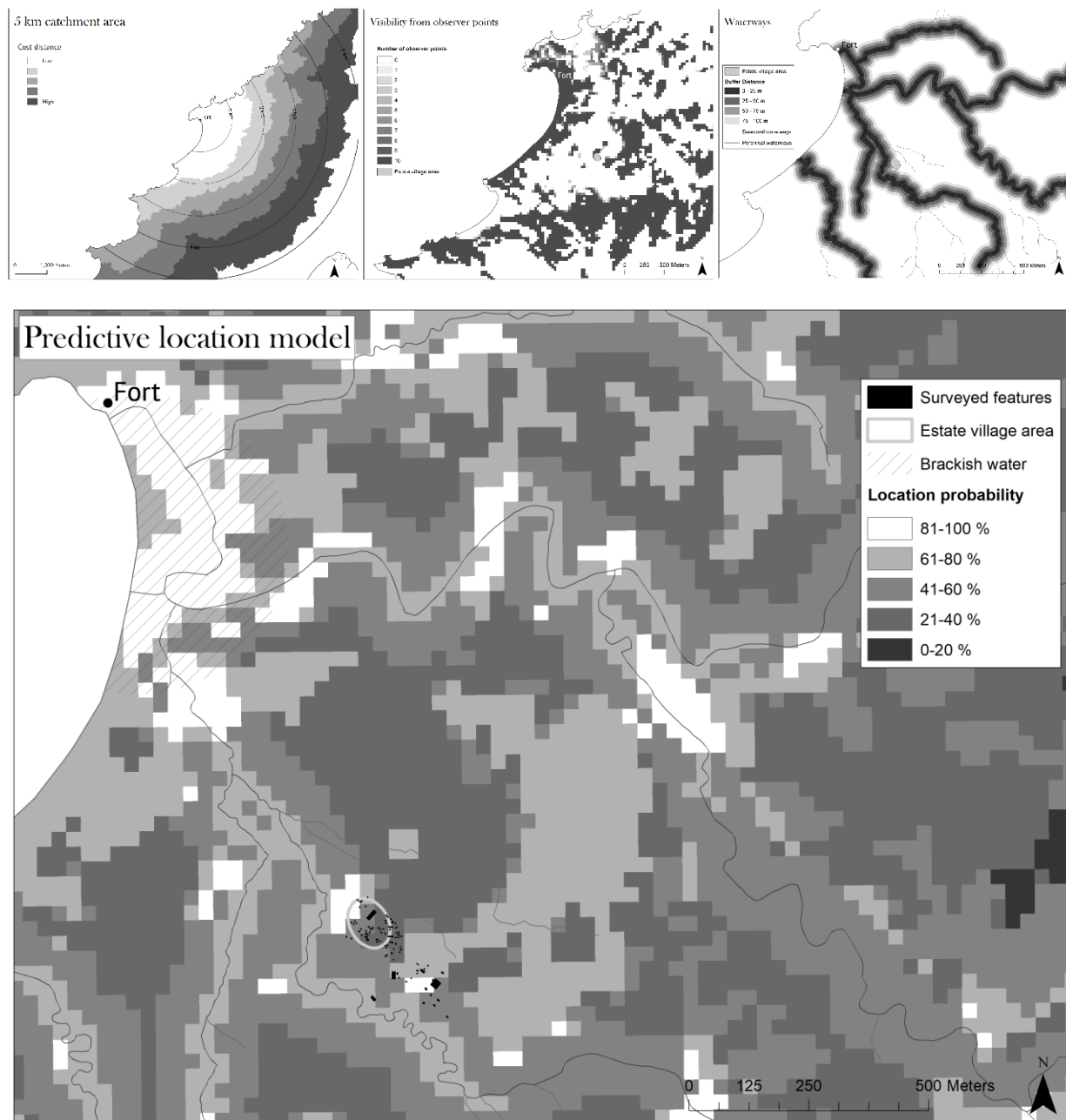


Figure 14: Predictive location model

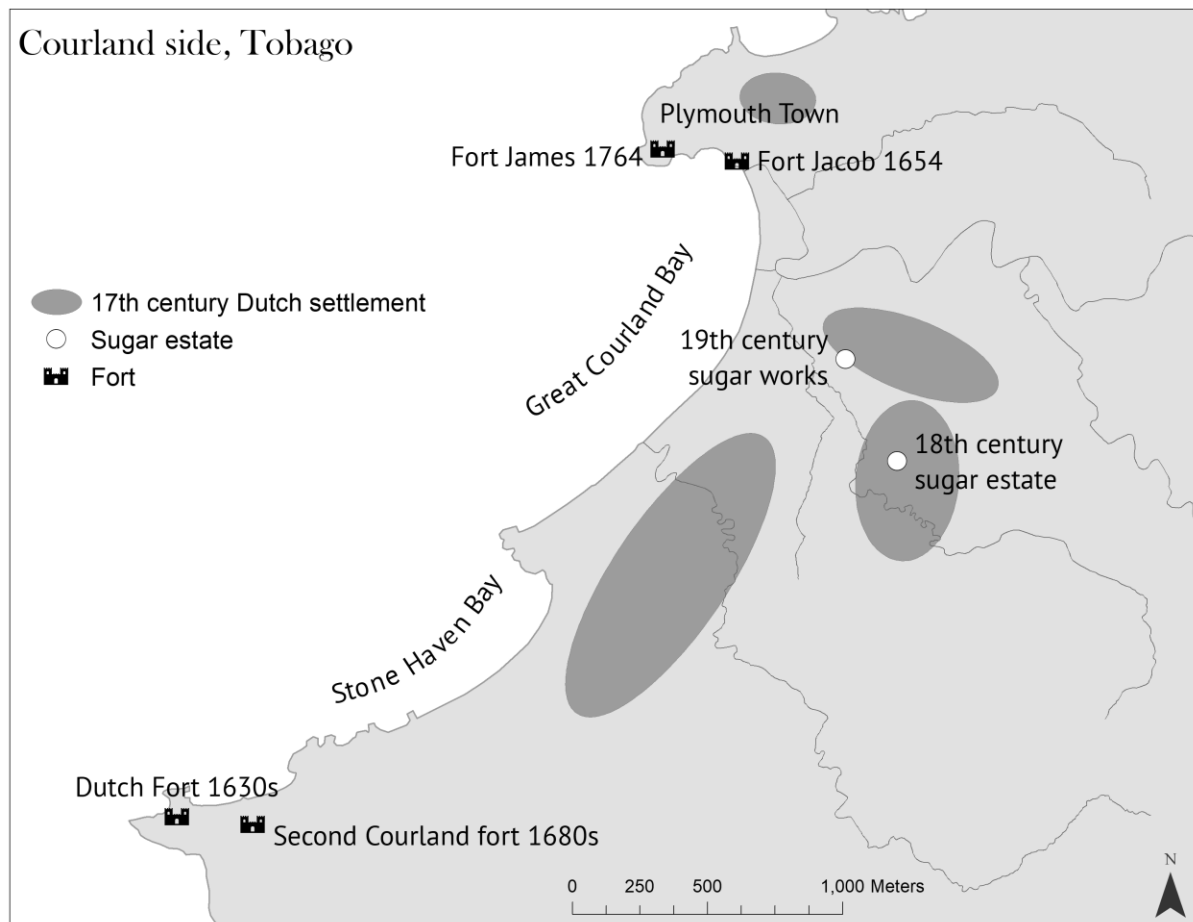


Figure 15: The area of New Courland colony, also known as Courland side, and locations referenced in this text

Approximate areas of the 17th-century Dutch settlement taken from the drawing of the Spanish attack on Nieuw Vlissingen in 1636 (Anderson, 1970, plate XII).

The human factor must not be discounted. The decision of placement was ultimately made by an individual or a group of individuals who made a choice based on their personal preferences, which were not necessarily logical or predictable.

Several other locations, mainly along the Courland River, match the parameters of a sugar mill site. Nevertheless, further examination of these sites is beyond the scope of

the current research. Additionally, the suitability of the Belle Island area directly south of the fort is questionable due to references of poor quality, brackish drinking water on 18th-century maps.



Figure 16: Aerial photo of Courland estate area with 1995 survey features

Circle on the left indicates the mystery feature. Source: GeoSpatial Information Portal for Tobago.

In the process of surveying the Courland Estate area via aerial photography, an unmapped feature was observed directly west of the site surveyed by Clement in 1995

(Figure 16). The survey description mentions multiple features present south and southwest of the recorded estate structures, though they are not found on any of the available maps. The aerial photography image appears to show a circular stone foundation, approximately 13 m in diameter, situated between a freshwater stream and a road. The size of the feature is within range of Caribbean animal-powered crushing mills (Meide, 2003) and is located in a high probability area of a sugar mill site. I would recommend a ground survey to determine the origin of this unknown structure.

Limitations of study

Remote sensing and GIS, while being exceptionally useful tools, are obviously limited by not having physical access to the study area. I have not been able to visit Tobago in person and confirm my findings on site. The same applies to physical access to archives which are located in Riga, Latvia, and on Tobago. Another problem with documentary sources on the Duchy of Courland and its Tobago colony arises from the frequent political changes during which documents were moved or destroyed. Parts of the ducal archives were moved to Sweden during the Great Northern War of the 1700s. In 1905, the Duchy of Courland archives were relocated to St. Petersburg, Russia and only partly returned to Latvia following its independence. Later, the same archives were evacuated to Berlin where they burned in a fire during World War II. A fraction of the original Courland archives has been returned to Latvian State Archives after World War II and has not yet been digitized.

CONCLUSION

Prior to the beginning of this research project, my knowledge of the New Courland colony was limited to fictional texts and popular stories about the brave Latvians who crossed the Atlantic in the 17th century, built a prosperous colony, and whose influence is still present in modern-day Tobago. A year and a half later, this vision, based on Latvian popular culture, has been entirely shattered. Reassessment of sources only amplifies the gaps in the data.

Several conclusions, however, can be drawn from this research. The location of Fort Jacob was mapped, consistent with the location of Nieuw Vlissingen, and separate from Fort James in Plymouth. The predictive GIS model has confirmed that the 18th-century British sugar estate was a suitable site for a sugar mill during the New Courland period. There is now more clarity on which textual sources are accurate and which are based on fiction. For one, the number of fortifications along the Great Courland Bay in the 17th century can be narrowed down to just three, namely the first Dutch fort at Black Rock, the Dutch and Courlander fort at Plymouth, and the 1680s fortification at Stone Haven Bay. There appears to be a continuity of settlement in the Great Courland Bay area since the first Dutch colony, with little or no interruption. Structures were rebuilt, supplies were reused, and information was exchanged. New Courland was far from isolated; it received regular shipments from Europe, interacted with the Dutch, other West Indies colonies, and Amerindians. Population and supply movement was particularly significant between Tobago and Barbados. The world in the 17th century was already well connected and multicultural.

The significance of this study is mainly in changing the perception of Courland's Tobago colony. It applies to both sides, those who trust the exaggerated accounts of the flourishing settlement of free Latvians, founded on Duke Jacob's riches, and the skeptics who believe New Courland was a failure. The truth is somewhere in the middle. To help uncover the whole story, it would be necessary to gain access to archive materials, to digitize them and make available online. With access to the original documents, it will no longer be justifiable to base research on erroneous secondary sources.

Another way to improve our knowledge of the New Courland colony is to conduct archaeological fieldwork in the Great Courland Bay area of Tobago. The site of Fort Jacob is particularly suitable for a survey because it has not been built on since the 18th century. This study can provide a framework for the design of such project.

REFERENCES

- Anderson, E. (1970). *Senie kurzemnieki Amerikā un Tobāgo kolonizācija*. Stockholm: Daugava.
- Arbell, M. (1993). The failure of the Jewish settlement in the island of Tobago. *Proceedings of the World Congress of Jewish Studies*, 303-310. Retrieved from <http://www.jstor.org/stable/23536858>
- Berkis, A. V. (1954). A history of the Duchy of Courland, 1561-1795. Retrieved from <http://digital.library.wisc.edu/1793/38193>
- Boomert, A. (2015) *The indigenous peoples of Trinidad and Tobago from the first settlers until today*. Sidestone Press. Retrieved from <https://www.scribd.com/doc/301963171/9789088903533>
- Boomert, A., Ortiz-Troncoso, O. R., & Van Regteren Altena, H. H. (1987). Archaeological - historical survey of Tobago, West Indies. *Journal de la Société des Américanistes* 73, 246-258. <https://doi.org/10.3406/jsa.1987.1039>
- Bowen, T. (1778). A map of the island of Tobago [Map]. Retrieved from <http://www.caribmap.org/index.php?id=tago&link=1778-tt-bowen>
- Byres, J. (1776). Plan of the island of Tobago, laid down by actual survey under the direction of the Honorable the Commissioners for the Sale of Lands in the Ceded Island by John Byres Chief Surveyor 1776 [Map]. Retrieved from <https://jcb.lunaimaging.com/luna/servlet/detail/JCBMAPS~1~1~3349~101614>
- Carta esférica de la Ysla de Tabago [Map]. (1793). Retrieved from <https://www.loc.gov/item/90680622/>
- Charan, R. (2017). Les Coteaux's other secret. *Trinidad Express*. Retrieved from <http://www.trinidadexpress.com/20170528/features/les-coteauxs-other-secret>
- Clement, C. O. (1995) Landscapes and plantations on Tobago: A regional perspective. (Doctoral dissertation). Retrieved from <http://ufdc.ufl.edu/AA00003595/00001/1j>
- Clement, C. O. (1997). Settlement patterning on the British Caribbean island of Tobago. *Historical Archaeology*, 31(2), 93-106. <https://doi.org/10.1007/bf03373605>
- Corps. of Engineers. (1940). Trinidad and Tobago: Tobago: grid zone "St. Thomas" sheet 1 [Map]. Retrieved from <http://ufdc.ufl.edu/UF00026343/00001>

- Defense Mapping Agency. (1995). West Indies, Trinidad and Tobago, Tobago [Map]. Retrieved from <http://ufdc.ufl.edu/UF00065423/00001>
- De Hooghe, R. (1677). Afbeeldingh Der heer rescontrete Water en te Lant op het Eylandt Tabago, Tusschen den Fransen Admirael d'Estrée, en den Heer Commandeur Binckes; In de meanden van February et Maert 1677 [Map]. Retrieved from <https://jcb.lunaimaging.com/luna/servlet/detail/JCB~1~1~955~1210003>
- Dell'Unto, N., Landeschi, G., Leander Touati, A.-M., Dellepiane, M., Callieri, M., & Ferdani, D. (2016). Experiencing ancient buildings from a 3D GIS perspective: A case drawn from the Swedish Pompeii Project. *Journal of Archaeological Method and Theory*, (1), 73. <https://doi.org/10.1007/s10816-014-9226-7>
- D'Urso, M. G., Corsi, E., Nemeti, S., & Germani, M. (2017). From excavations to web: A GIS for archaeology. *ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLII-5/W1, 219–226. <https://doi.org/10.5194/isprs-archives-xlii-5-w1-219-2017>
- Edwards, B. (1799). Map of the island of Tobago for the history of the West Indies by Bryan Edwards Esqr [Map]. Retrieved from <https://jcb.lunaimaging.com/luna/servlet/detail/JCBMAPS~1~1~2654~101191>
- Environmental Systems Research Institute (ESRI). ArcGIS Desktop: Release 10.5. 2016.
- Fisher, P. F. (1992). First experiments in viewshed uncertainty: simulating fuzzy viewsheds. *Photogrammetric Engineering and Remote Sensing*, 58, 345–345.
- Food and Agriculture Organization of the United Nations. (1993). Manual on the employment of draught animals in agriculture. Retrieved from www.fao.org.
- Fry, G. L. A., Skar, B., Jerpåsen, G., Bakkestuen, V., & Erikstad, L. (2004). Locating archaeological sites in the landscape: a hierarchical approach based on landscape indicators. *Landscape and Urban Planning*, 67(1–4), 97–107. [https://doi.org/10.1016/s0169-2046\(03\)00031-8](https://doi.org/10.1016/s0169-2046(03)00031-8)
- Goslinga, C. C. (1971). *The Dutch in the Caribbean and on the Wild Coast 1580-1680*. Gainesville, Fla.: University of Florida Press, 1971.
- Hards, Vaughan, & Jenkinson. (1879). Tobago, particulars of a valuable Sugar Estate: known as "Courland," in the parishes of St. David and St. Patrick, in the Island of Tobago, containing 860 acres, or thereabouts, together with the buildings, fixtures, machinery, & live & dead stock thereon [Map]. Available from <https://lccn.loc.gov/2015587697>

- Harlow, V. T. (2017). *Colonising expeditions to the West Indies and Guiana, 1623-1667*. Taylor & Francis. (Original work published 1925). Retrieved from <https://books.google.com/books?id=XAkDwAAQBAJ>
- Hewitt, C. M. (2016). Was the Battle of Hastings really fought on Battle Hill? A GIS assessment. *Historical Geography*, 44, 127-148.
- Huyghues-Belrose, V. (2007). The early colonization of Tobago: Bibliographical and archival material in Martinique and France. *Études Caribéennes*, 8. <https://doi.org/10.4000/etudescaribeennes.1032>
- Jefferys, T. (1765). Tobago from actual surveys and observations [Map]. Retrieved from <http://ark.digitalcommonwealth.org/ark:/50959/6t053r203>
- Jekabson-Lemanis, K. (2000). Balts in the Caribbean: The Duchy of Courland's attempts to colonize Tobago Island, 1638 to 1654. *Caribbean Quarterly*, 46(2), 25-44. <https://doi.org/10.1080/00086495.2000.11672115>
- Kenins, I. (2014). Kurzemes-Zemgales hercogiste. Retrieved from <https://www.historia.lv>
- Kitchin, T. (1771). A new map of the island of Tobago shewing all the rocks, shoals and soundings Engraved from an actual survey by Thos. Kitchin [Map]. Retrieved from <https://jcb.lunaimaging.com/luna/servlet/detail/JCBMAPS~1~1~3347~101628>
- Latham, G. H. (1926). Tobago topographic map 1:50,000 [Map]. Retrieved from <http://www.caribmap.org/index.php?id=tago&link=1926-tobago-latham>
- Ligon, R. (2014). *A True and Exact History of the Island of Barbados* (5th ed.). D. C. Smith (Ed.). (Original work published 1657). Retrieved from <https://www.davidchansmith.net/the-richard-ligon-project>
- Llobera, M. (1996). Exploring the topography of mind: GIS, social space and archaeology. *Antiquity*, 70(269), 612-622. <https://doi.org/10.1017/S0003598X00083745>
- Llobera, M. (2001). Building past landscape perception with GIS: Understanding topographic prominence. *Journal of Archaeological Science*, 28(9), 1005-1014. <https://doi.org/10.1006/jasc.2001.0720>
- Loots, L., Nackaerts, K., & Waelkens, M. (1999). Fuzzy viewshed analysis of the Hellenistic city defence system at Sagalassos, Turkey. *BAR International Series*, 750, 82-82.

- Map of Tobago showing native dwellings [Map]. (1756). Retrieved from <http://www.bl.uk/onlinegallery/onlineex/carviews/m/022add000071066u0000oioo.html>
- Matthiesen, O. H. (1940). Die kolonial und Ueberseepolitik Herzog Jakobs von Kurland, 1640-1660. Retrieved from <http://archive.org/details/OttoHeinzMatthiesenDieberseepolitikHerzogJakobsVonKurland>
- Meide, C. (2003). The sugar factory in the colonial West Indies: An archaeological and historical comparative analysis. Retrieved from https://www.academia.edu/3258102/The_Sugar_Factory_in_the_Colonial_West_Indies_an_Archaeological_and_Historical_Comparitive_Analysis.
- Merritt, H. C. (2010). The colony of the colonized: The Duchy of Courland's Tobago colony and contemporary Latvian national identity. *Nationalities Papers*, 38(4), 491–508. <https://doi.org/10.1080/00905992.2010.482131>
- Murrieta-Flores, P., & Gregory, I. (2015). Further frontiers in GIS: Extending spatial analysis to textual sources in archaeology. *Open Archaeology*, 1. <https://doi.org/10.1515/opar-2015-0010>
- Poyntz, J. (1683). The present prospect of the famous and fertile island of Tobago with a description of the situation, growth, fertility and manufacture of the said island, to which is added proposals for the encouragement of all those that are minded to settle there. Retrieved from <http://name.umd.umich.edu/A55601.0001.001>
- Reja en la Ysla de Tabago [Map]. (1600 - 1699). Retrieved from <http://gallica.bnf.fr/ark:/12148/btv1b8596376t>
- Richards-Rissetto, H. (2017). What can GIS + 3D mean for landscape archaeology? *Journal of Archaeological Science*, 84, 10-21. <https://doi.org/10.1016/j.jas.2017.05.005>
- De Rochefort, C. (1667). Histoire morale des Iles Antilles de l'Amérique. Retrieved from <https://books.google.com/books?id=GltoKHeYaHUC>
- Ruestes Bitrià, C. (2008). A Multi-technique GIS visibility analysis for studying visual control of an Iron Age landscape. *Internet Archaeology*, 23. <https://doi.org/10.11141/ia.23.4>
- Seller, J. (1682). The Island of Tobago [Map]. Retrieved from <https://jcb.lunaimaging.com/luna/servlet/detail/JCBMAPS~1~1~1603~102040001>

- Sooman, I., McFarlane, J., Tēraudkalns, V., & Donecker, S. (2013). From the port of Ventspils to Great Courland Bay: The Couronian colony on Tobago in past and present. *Journal of Baltic Studies*, 44(4), 503–526.
<https://doi.org/10.1080/01629778.2013.835464>
- USDA Forest Service. (2012). Inventory of the indigenous forest of Tobago [Map]. Caribbean Island Land Cover. Retrieved from
<https://data.fs.usda.gov/geodata/rastergateway/caribbean/index.php>
- Vingboons, J. (1665). Bird's eye view of the bay and the fort of Nieuw Vlissingen on Tobago [Map]. Vingboons Atlas. Retrieved from
<http://www.atlasofmutualheritage.nl/en/Birds-eye-view-bay-fort-Nieuw-Vlissingen-on-Tobago.6798>
- von Schwerin, J., Richards-Rissetto, H., Remondino, F., Agugiaro, G., & Girardi, G. (2013). The MayaArch3D project: A 3D WebGIS for analyzing ancient architecture and landscapes. *Literary and Linguistic Computing*, 28(4), 736–753. <https://doi.org/10.1093/llc/fqt059>
- Wheatley, D., & Gillings, M. (2000). Vision, perception and GIS: developing enriched approaches to the study of archaeological visibility. *NATO ASI Series A Life Sciences*, 321, 1–27.
- Wilcoxon, C. (1987). *Dutch trade and ceramics in America in the seventeenth century*. SUNY Press.
- Zamora, M. (2007). Total and cumulative viewshed: An application in the Genil River Valley. Proceedings of the XXXIII Computer Applications and Quantitative Methods in Archaeology Conference (March 2005, Tomar, Portugal). Retrieved from
http://proceedings.caaconference.org/files/2005/45_Zamora_CAA_2005.pdf